RULES
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REGULATIONS

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RULES AND REGULATIONS.

(SCANTLINGS IN METRIC UNITS.)

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GEORGES PHILIPPAR, C.✲
Président du Comité Central des Armateurs de France,
Membre de l'Académie de Marine et de l'Académie des Sciences Coloniales,
Président des Conseils d'Administration des Messageries Maritimes,
Président des Sociétés Provençales de Constructions Navales et Aéronautiques,
Vice-Président des Compagnies Maritimes de l'Afrique Orientale (Djibouti et Diégo-Suarez),
Administrateur de la Société Générale de Remorquage et de Travaux Maritimes (Cie. Chambon) et de la Société Générale de Transbordements Maritimes,
Administrateur de la Banque de Madagascar.

MAURICE PILLIARD, O.✲
Président de la Compagnie Auxiliaire de Navigation,
Président de la Compagnie Africaine d'Armement,
Président de la Société Alsacienne de Navigation Rhénane,
Administrateur de la Compagnie des Messageries Maritimes,
Administrateur de la Société des Services Contractuels des Messageries Maritimes.

M. TILLIER, O.✲
Administrateur de la Société Maritime Nationale,
Administrateur de la Compagnie Nazairienne de Remorquage et de Sauvetage,
Administrateur de la Société de Remorquage et Sauvetage "Les Abeilles,"
Administrateur de la Société Cherbourgeoise de Remorquage et de Sauvetage.

GEORGES UBALD-BOCQUET,✲ et Croix de Guerre.
Assureur Maritime.

F. ZIEGEL, O.✲
Ancien Ingénieur du Génie Maritime,
Arbitre-Expert près le Tribunal de Commerce de la Seine, le Tribunal Civil et la Cour d'Appel,
Administrateur-Délégué de la Soudure Autogène Française,
Ingénieur Conseil de l'Air Liquide.

SECRÉTAIRE :
JEAN TAXIL, ✲

G.O.✲ Grand Officier de la Légion d'Honneur. C.✲ Commandeur de la Légion d'Honneur. O.✲ Officier de la Légion d'Honneur.
✲ Chevalier de la Légion d'Honneur.

Bureaux, 80, *Boulevard Haussmann, Paris,* 8.
1 *Juillet,* 1937.

LLOYD'S REGISTER OF SHIPPING.

SWEDISH COMMITTEE.

1937–1938.

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CONSUL GUNNAR CARLSSON, *Vice-Chairman.*

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SECRETARY:
V. C. BÜLOW.

SENIOR SURVEYOR AT GOTHENBURG:
S. TOWNSHEND.

Office: Norra Hamngatan 6, *Gothenburg.*

1*st July*, 1937.

LLOYD'S REGISTER OF SHIPPING.

HOLLAND COMMITTEE.

1937–1938.

J. Rypperda Wierdsma, *Chairman.*

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F. de Boer, Stoomvaart Maatschappij "Nederland," Amsterdam.

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PRINCIPAL SURVEYOR FOR HOLLAND:

R. Leeuwenburg.

Office: Willemskade, 11B, *Rotterdam.*

1*st July*, 1937.

LLOYD'S REGISTER OF SHIPPING.

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1937–1938.

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H. P. CHRISTENSEN, *Deputy-Chairman.*

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H. P. CHRISTENSEN, Aktieselskabet Helsingörs Jernskibs-og Maskinbyggeri, Elsinore.

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CONSUL-GENERAL JOHAN HANSEN, C. K. Hansen, Copenhagen.

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C. H. KRUHÖFFER.

Office: Skt. Annæ Plads 28[1], *Copenhagen, K.*

1*st July*, 1937.

LLOYD'S REGISTER OF SHIPPING.

JAPAN COMMITTEE.

1937–1938.

K. HORI, *Chairman.*

N. OHTANI, *Vice-Chairman.*

G. ABE, Naval Architect, Tokio.

T. ASAI, *Director*, Nippon Yusen Kaisha, Ld., Tokio.

S. ASAKAWA, Member of Nihon Zosen Kyokai, Tokio.

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M. ITANI, *President*, Kawasaki Kisen Kaisha, Ld., Kobe.

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S. KAMEYAMA, *Managing Director*, Mitsubishi Insurance Co., Tokio.

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K. MATSUI, *General Manager*, Mitsubishi Jukogyo Kaisha, Ld., Kobe.

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T. MERA, D.Eng., *Naval Architect*, Kobe.

N. MOTORA, D.Eng., *Managing Director*, Mitsubishi Jukogyo Kaisha, Ld., Tokio.

T. MUKAI, *Managing Director*, Mitsui Bussan Kaisha Ld., Tokio.

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K. TAMIYA, *President*, Kobe Steel Works, Ld., Kobe.

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Vice-Admiral K. TERASHIMA, *President*, Uraga Dockyard Co., Ld., Tokio.

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M. YASUDA, *President*, Dairen Kisen Kaisha, Ld., Kobe.

R. YOKOO, *Managing Director*, Harima Shipbuilding & Engineering Co., Ld., Harima.

Vice-Admiral Y. YOSHIOKA, *Managing Director*, Kawasaki Dockyard Co., Ld., Kobe.

TECHNICAL ADVISER TO THE JAPAN COMMITTEE:

T. MERA, D.Eng.

PRINCIPAL SURVEYOR FOR THE FAR EAST:

H. JASPER COX.

Office: 32, *Akashi Machi* (*Meikai Building*), *Kobe.*

1*st July*, 1937.

LLOYD'S REGISTER OF SHIPPING

AND THE

REGISTRO ITALIANO NAVALE ED AERONAUTICO.

NOTICE.

In pursuance of the wishes of the Italian Government, an amalgamation was effected between the two Italian Classification Institutions, previously known as the Registro Navale Italiano, with headquarters at Genoa, and the Veritas Adriatico, with headquarters at Trieste, in order to establish one Italian register of shipping, under the name of the Registro Italiano, now known as Registro Italiano Navale ed Aeronautico.

A new Agreement, which came into operation on the 1st November, 1934, has been arrived at between the Registro Italiano and Lloyd's Register, with the object of facilitating as far as possible the classification of vessels with both Societies in the interests of shipowners, shipbuilders and underwriters.

The terms of the new Agreement follow very closely those of the original, but some modifications in the surveying arrangements have been made, in order to obviate certain inconveniences which had been found to exist.

Each Institution will, as formerly, give every facility for the assignment of its classification to vessels classed, or intended to be classed, by the other Society, provided the standard of strength and security is not inferior to that required by its own Rules, each Institution reserving to itself the right of confirming the class by means of surveys by its own Surveyors.

Surveys on vessels holding, or intended to hold, the classification of both Societies will be carried out by Surveyors of Lloyd's Register and the Registro Italiano either jointly, or, in the case of specified surveys and testing operations in some districts in Italy, by certain Exclusive Surveyors of the Registro Italiano, who have been appointed Non-Exclusive Surveyors of Lloyd's Register for the purpose of the Agreement.

REGISTRO ITALIANO NAVALE ED AERONAUTICO.

Registered Office & President's Office: ROME. Management Office: GENOA.

CONSIGLIO DI AMMINISTRAZIONE:

Presidente:

S.E. Cav. Gr. Cr. Amm. Alfredo Baistrocchi, Consigliere di Stato.

Vice Presidenti:

Gr. Uff. Dott. Ing. Michele Fileti.

Gr. Uff. Edgardo Morpurgo.

Membri di diritto:

S.E. Cav. Gr. Cr. Amm. Alfredo Baistrocchi (*predetto*), Presidente del Comitato Direttivo di R.I.N. ed A.

Tenente Generale di Porto Ispettore Cav. di Gr. Cr. Giulio Ingianni, Direttore Generale della Marina Mercantile (Ministero delli Comunicazioni).

Dott. Gr. Uff. Antonio Crispo, Ispettore Generale delle Ferrovie, Tramvie ed Automobili (Ministero delle Comunicazioni).

S.E. Comm. Aldo Pellegrini, Generale di Squadra Aerea, Capo dell'Ufficio Aviazione Civile e Traffico Aereo (Ministero dell'Aeronautica).

Colonnello di Porto Comm. Alceste Grifoni, Capo dell'Ufficio Marina Mercantile del Ministero delle Colonie.

Comm. Alberto Quojani, Maggoir Generale Genio Navale, R.N. Consulente Tecnico del Comitato Direttivo di R.I.N. ed A.

Gen. G. A. Gr. Uff. Giulio Costanzi, Consigliere di Stato, Consulente Tecnico Aeronautico.

S.E. On. Avv. Cav. di Gr. Cr. Roberto De Vito, Senatore del Regno, Consulente Economico del Comitato Direttivo di R.I.N. ed A.

On. Conte Giovanni Cao di San Marco, Deputato al Parlamento, Presidente della Federazione Nazionale Fascista esercenti Imprese di trasporti marittimi ed ausiliarie.

On. Ammiraglio Cav. di Gr. Cr. Conte Alfredo Dentice di Frasso, Deputato al Parlamento, Presidente della Federazione Nazionale Fascista degli esercenti Imprese di trasporti aerei.

Dott. Comm. Bruno De Mori, Direttore Generale della Unione Italiana di Riassicurazione.

Membri nominati da S.E. il Ministro per le Comunicazioni:

Gr. Uff. Dott. Ing. Michele Fileti (*predetto*) Esperto in materia di Navigazione Marittima.

Tenente Generale del Genio Navale Carlo Buffa, Capo Divisione On. Ministero dell'Aeronautica.

CONSIGLIO DI AMMINISTRAZIONE (*continued*).

Membri nominati da S.E. il Ministro per l'Aeronautica:

Dott. Cav. Salvatore Cacopardo, Esperto in materia di Navigazione Aerea.

Dott. Ing. Gr. Uff. Magg. Gen. G. A. Amedeo Fiore, Esperto in materia di Costruzioni Aeronautiche.

Membri designati da Organizzazioni Sindacali:

Federazione Nazionale Fascista degli esercenti Imprese di trasporti marittimi ed ausiliarie:

Gr. Uff. Comm. Maur. Dott. Ing. Giuseppe Lojacono.

Gr. Uff. Avv. Gio. Batta Becchi.

Confederazione Fascista degli Industriali:

Per le Industrie costruzione navali:

Gr. Uff. Dott. Ing. Cesare Sacerdoti.

Per le Industrie costruzioni meccaniche:

Comm. Dott. Ing. Alessandro Marchetti.

Per le Industrie Siderurgica:

On. Cav. di Gr. Cr. Dott. Ing. Giorgio Falck, Senatore del Regno.

Confederazione Fascista delle Aziende del Credito e dell'Assicurazione:

Per le aziende di Assicurazione Marittima:

Gr. Uff. Edgardo Morpurgo, Presidente delle Assicurazioni Generali.

Per le aziendi di Assicurazione Aeronautica:

Dr. Gr. Uff. Arnaldo Frigessy di Rattalma, Vice Presidente della Spett. Riunione Adriatica di Sicurtà.

Confederazione Fascista dei lavoratori dell'Industria:

Per le Gente del Mare:

On. Comm. Davide Lembo, Deputato al Parlamento.

Per le Gente dell'Aria:

Gr. uff. Dr. Manlio Molfese.

Confederazione Fascista dei Commercianti:

Gr. Uff. Avv. Pietro Onorati, Capo. Uff. legale della Confederazione predetta.

Sindacato Fascista degli Ingegneri:

Cav. di Gr. Cr. S.E. Giuseppe Rota, Senatore del Regno, Generale Ispettore del Genio Navale.

COMITATO DIRETTIVO:

Presidente:

S.E. Cav. Gr. Cr. Amm. Alfredo Baistrocchi (*predetto*).

Consulente Tecnico:

Comm. Alberto Quojani, (*predetto*).

Gr. Uff. Giulio Costanzi.

Consulente Economico:

S.E. On. Avv. Cav. di Gr. Cr. Roberto de Vito, (*predetto*).

Il Direttore Generale e Navale:

Gr. Uff. Dott. Ing. Domenico Barricelli (*predetto*).

Il Direttore Aeronautico:

Cav. Uff. Ing. G. Cesare Magaldi.

COMITATO TECNICO:

Sezione Navale;

Membri nominati da S.E. il Ministro delle Comunicazioni:

Gen. G. N. Gr. Uff. Dott. Ing. Luigi Barberis, Presso On. Ministero delle Comunicazioni, Direzione Generale della Marina Mercantile.

Comm. Dott. Ing. Leonardo Fea, Professore R. Scuola d'Ingegneria di Napoli (Sezione Navale).

Cav. Carlo Civallero, Maggiore di Porto.

Cav. Cap. di L. C. Roberto Stuparich.

Membri nominati dal Consiglio d'Amministrazione:

Comm. Dott. Ing. Ernesto Gobbi.

Gr. Uff. Dott. Ing. Eugenio De Vito.

Gr. Uff. Dr. Ing. Giuseppe Loiacono.

Gr. Uff. Dr. Ing. Cesare Sacerdoti.

Membro di diritto:

Magg. Gen. G. N. Comm. Alberto Quojani.

Gr. Uff. Dott. Ing. Domenico Barricelli, Direttore de Registro Italiano Navale ed Aeronautico.

Membro aggiunto:

Cav. Maur. Dott. Ing. Prof. Angelo Mengoli.

Sezione Aeronautica;

Membri nominati da S.E. il Ministro dell'Aeronautica:

Gr. Uff. Dott. Ing. Prof. S.E. G. Arturo Crocco, Tenente Generale del Genio Aeronautico.—Direttore Superiore degli Studi e delle Esperienze Aeronautiche-Accademico d'Italia.

Cristoforo Ferrari, Tenente Generale del Genio Aeronautico. — Direttore Superiore degli Studi e delle Esperienze Ministero Aeronautico.

Membri nominati dal Consiglio d'Amministrazione:

Dott. Ing. Prof. Comm. Anastasio Anastasi, Professore di Macchine Termiche presso On. R. Scuola di Ingegneria di Roma.

Comm. Dott. Ing. Gianni Caproni, Presidente della Società «Caproni», Milano.

Comm. Dott. Ing. Amedeo Fiore, Maggior Generale del Genio Aeronautico.—Direttore Generale Costruzioni e Approvvigionamenti Ministero Aeronautico.

Gr. Uff. Dott. Ing. Alessandro Marchetti.

Membro di diritto:

Gen. G. A. Gr. Uff. Giulio Magaldi.

Cav. Uff. Dott. Ing. G. C. Magaldi, Capo del Reparto Aeronautico.

Membri Aggiunti:

Avv. Prof. Antonio Ambrosini, Professore di Diritto Aeronautico presso On. R. Scuola di Ingegneria di Roma.

Dott. Ing. Prof. Comm. Modesto Panetti, Professore di Aerodinamica e Meccanica Applicata presso On. R. Scuola di Ingegneria di Torino.

Comm. Dott. Ing. Rodolfo Verduzio, Prof. di costruzione dei Velivoli, R. Scuola Ingegneria di Roma.

DIRETTORE DELL'ISTITUTO:

Gr. Uff. Dott. Ing. DOMENICO BARRICELLI.

LIST OF SURVEYORS.

LLOYD'S REGISTER OF SHIPPING.

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THE SURVEYORS AT THE FOLLOWING PORTS ARE EXCLUSIVELY THE OFFICERS OF THE SOCIETY, AND ARE NOT PERMITTED TO ENGAGE IN ANY OTHER BUSINESS OR EMPLOYMENT WHATSOEVER.

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PRINCIPAL SURVEYORS ON THE CHIEF ENGINEER SURVEYOR'S STAFF ... A. A. A. Chalmers, W. D. Heck, B.Sc.

PRINCIPAL ELECTRICAL ENGINEER SURVEYOR ON THE CHIEF ENGINEER SURVEYOR'S STAFF ... ... G. O. Watson.

PRINCIPAL SURVEYOR FOR RESEARCH ... ... W. Thomson, B.Sc.

PRINCIPAL SURVEYOR FOR AIRCRAFT ... ... L. J. Hill.

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H. J. Adams, B.Sc.
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H. N. Pemberton
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R. Munton, B.Sc.
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(TELEPHONE NO. 2836)

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Ship Surveyor ... ... T. Richardson
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(TELEPHONE NO. 141)

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(Office, Ramsden Square, Barrow)
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Ship Surveyors ... ... — F. C. Cocks, B.Sc.; W. M. Balfour, B.Sc.; C. A. Townshend; A. P. Scott

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Ship and Engineer Surveyor ... ... — H. McCririck

Inspector of Forgings ... ... (Office, Lancaster House, Newhall Street, Birmingham, 3) (TELEPHONE No. *Central* 6791) — E. R. Best

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- R. Fairley
- T. R. McIlvenna
- H. P. Urwin
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- S. W. Bolwell, M.Eng.
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	Ship Surveyor	W. Malcolm, B.Sc.

Beams at W.T. Decks / Overframe same size as stiffeners Table 28. having regard to spacing, but not less than the Table beam.

Beams at Gunnel Recesses. ~~Longitudinal~~ ~~Cofferdam~~ Cargo size modified in regard to height of cargo carried above but not in any case less than at a W.T. Deck.

Crown of {Oil Fuel Tanks / Deep Tanks / ~~Peak tanks~~} Overframe scantlings as per Table 12, but not in any case less than the stiffeners required for the boundary bhds or of less depth necessary to stand a press of 9 tons under test head.

~~Tanks~~ Shelf Gunnel 18.
W.T.B 17.
Pillars 16.

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Ship Surveyors ... ... — J. Hodgson; S. Sandersen; W. D. Lydersen, B.Sc.; H. K. Juul

(Office, Skt. Annae Plads 28[1], Copenhagen, K.) — (TELEGRAMS, *Engineer* TELEPHONE No. 5760)

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(TELEGRAMS, *Register*; TELEPHONE NO. 24218)

GIBRALTAR.

GIBRALTAR, *with a district including Tangier, Ceuta, Tetuan (Rio Martin), Melilla and Villa Sanjurjo ... ... Ship and Engineer Surveyor ... ...* (Address, Waterport) — *W. J. Matthews (TELEGRAMS, *Repsalve*; TELEPHONE NO. 257 AUTOMATIC)

ITALY.

ANCONA, *Acting Ship and Engineer Surveyor ... ...* (Address, Via Fazioli) — *G. Badia (TELEGRAMS, *Gustavo Badia, Ancona*)

FIUME, *Ship and Engineer Surveyor* (Address, Piazza Dante 1/111) — Z. A. Ozegovic (TELEGRAMS, *Register*; TELEPHONE NO. 867)

GENOA ... ... — J. S. Ormiston, B.Sc., *Principal Surveyor for Italy*

Ship Surveyors ... ...
- Cav. Dott. Ing. I. Aureli
- A. C. Hunter, B.Sc.

SURVEYORS AT OTHER PORTS ABROAD—*continued.*

ITALY—*continued.*

GENOA—*continued.*		
	Ship and Engineer Surveyors	A. T. Griffith Dott. Ing. A. Grasselli G. de C. Ballardie, M.Sc.
	Surveyor for Steel-testing duties ... ... (Office, Piazza Cavour, 35, Genoa, III)	Cav. Uff. A. S. Mantelli (TELEGRAMS, *Surveyors*; AUTOMATIC TELEPHONE No. 22.862)
LEGHORN, *with district from Spezia (not including that port) to Civita-Vecchia*	*Ship and Engineer Surveyor* (Office, Via Ricasoli 22, Leghorn)	*Cav. Antonio Gori (TELEGRAMS, *Antonio Gori, Leghorn*; TELEPHONE No. 30-302)
MESSINA (*see* NAPLES)		
NAPLES, *including Terni and Palermo* ...	*Ship and Engineer Surveyor* (Address, Via A. Depretis 31, Naples, 176)	*A. Todaro (TELEGRAMS, *Surveyors*; AUTOMATIC TELEPHONE No. 21-485)
	Sub-Office at Messina for the ports of Messina, Syracuse and Catania ... *Assistant Ship and Engineer Surveyor* ... ... (Address, Pace, Messina)	*Guido Bottari (TELEGRAMS, *Bottari-Pace, Messina*; TELEPHONE No. 4-52)
TRIESTE, *with Pola and the Coast North of Pola; also Venice* ...		J. S. Ormiston, B.Sc. *Principal Surveyor for Italy*
	Ship Surveyors	M. Costantini, B.Sc. Ing. M. Micali
	Ship and Engineer Surveyors ... ... (Office, Via Mazzini 9, Trieste, III; Casella postale No. 2)	L. Stupari Cav. Uff. M. Bonivento N. Geniram G. T. Champness (TELEGRAMS, *Register*; TELEPHONE No. *Aut.* 44-20)

YUGOSLAVIA.

SPLIT	*Ship and Engineer Surveyor* (Address, Zgrada Trgovacke Komore, Trumbiceva obala, 4, Split, Yugoslavia)	J. Rundle (TELEGRAMS, *Register*; TELEPHONE No. 416)
SUSAK	*Ship and Engineer Surveyor* (Address, Tomislavova Ulice 4/11, Susak)	Z. A. Ozegovic (TELEGRAMS, *Register*)

CZECHO-SLOVAKIA.

PRAGUE	*Ship and Engineer Surveyor for steel testing duties* ... (Office, Starodruzinikù 2, Prague XIX.)	Ing. P. Kertscher (TELEGRAMS, *Surveyor*; TELEPHONE No. 716 16)

AUSTRIA.

VIENNA	*Ship and Engineer Surveyors for Steel testing duties, etc., in Austria, Hungary, Poland, German Upper Silesia, Czecho Slovakia at and East of railway line Bohumin-Breclav, and also including Czecho Silesia* ... (Office, Starhemberggasse No. 39[111], Kolschitzkyhof, Vienna IV/2)	H. L. Jung F. Schnell J. S. Helyer (TELEGRAMS, *Surveyor*; TELEPHONES, OFFICE, No. U. 40-4-79, PRIVATE, No. B20-216)

MALTA.

MALTA	*Ship and Engineer Surveyor* (Address, P.O. Box 83)	*L. J. Calcaterra (TELEGRAMS, *Seaworthy*)

GREECE.

PIRÆUS AND SYRA	*Ship and Engineer Surveyors* (Address, 61, Odos Notara, Piræus)	R. G. Knox, O.B.E. C. Moffatt (TELEGRAMS, *Register*; TELEPHONE No. 40-664)

ROUMANIA.

BRAILA	... ...	*J. Corbu (TELEGRAMS, *Jack Corbu*)

CANADA.

PRINCIPAL SURVEYOR FOR THE UNITED STATES AND CANADA ... ... (Office, 17, Battery Place, New York)		Wm. Bennett, B.Sc. (TELEGRAMS, *Nymdible, New York*)
HALIFAX, N.S.	*Ship and Engineer Surveyor* (Office, 37, Furness Withy Building)	T. Moon (TELEGRAMS, *Lloyd, Halifax, N.S.*; TELEPHONE No. B 7506)
MONTREAL AND QUEBEC, *with a district including the River St. Lawrence*	*Ship and Engineer Surveyor* (Office, 202, Lake of the Woods Building, Montreal)	G. Allan (TELEGRAMS, *Register*; TELEPHONE No. *Marquette* 2700
ST. JOHN, N.B.	*Ship and Engineer Surveyor*	*C. E. Dalton (TELEGRAMS, *Dalton*)
TORONTO, ONT., *with a district including all ports on the Canadian side of the Great Lakes from Kingston, Ont., to Port Arthur, Ont., inclusive* ...	*Ship and Engineer Surveyor* (Address, Room 510, Crown Office Building, 26, Queen Street East, Toronto)	*John Stephen (TELEPHONE No. *Elgin* 2637)
VANCOUVER, B.C.	*including Victoria, Vancouver Island, and all ports in British Columbia* ... ... *Ship and Engineer Surveyor* (Office, 1319, Marine Building, Vancouver, B.C.)	A. Scott (TELEGRAMS, *Registrar*; TELEPHONE No. *Seymour* 2022)

NEWFOUNDLAND.

ST. JOHNS	*Ship and Engineer Surveyor* (Office, King's Wharf Building)	D. M. Macfarlane (TELEGRAMS, *Surveyor*)

PANAMA CANAL ZONE.

BALBOA, *with a district including all ports in the Panama Canal Zone*	*Ship and Engineer Surveyor* (Office, 218, Pacific Terminal Building, Balboa; P.O. Box 304)	M. Dickson (TELEGRAMS, *Register, Balboa*; TELEPHONE No. 1831)

DUTCH WEST INDIES.

CURAÇAO, *including Aruba*	*Ship and Engineer Surveyors* (Address, Handelskade, 2, Willemstad; P.O. Box 169)	E. S. Whitham R. Little (TELEGRAMS, *Register*)

BRITISH WEST INDIES.

KINGSTON (JAMAICA)	*Ship and Engineer Surveyor* (Address, Royal Mail Building, Port Royal Street)	*E. Watson (TELEGRAMS, *Edwat, Jamaica*)

CUBA.

HAVANA	*Ship and Engineer Surveyor* (Address, San Pedro 4 (Altos), Apartado 843)	*T. F. Holmes (TELEGRAMS, *Holmes, Eureka, Havana*

SURVEYORS AT OTHER PORTS ABROAD—*continued.*

SOUTH AMERICA.

BUENOS AIRES AND ROSARIO ALSO MONTE VIDEO — *Ship and Engineer Surveyors* (Office, Calle 25 de Mayo 158, Buenos Aires) — J. C. G. Williamson; A. J. Matheson; A. W. Eaglesome; A. Daintith (TELEGRAMS, *Surveyors*; TELEPHONE No. *Avenida* 2364)

GEORGETOWN, DEMERARA — *Ship and Engineer Surveyor* (Address, 12, Water Street) — *A. G. Stirling

RIO DE JANEIRO — *Ship and Engineer Surveyor* (Office, Rua São Pedro 9, 2nd floor; Caixa Postal 563) — *H. E. Inman (TELEGRAMS, *Surveyor, Rio de Janeiro*; TELEPHONE No. *Norte* 4762)

TALCAHUANO, CHILI, *with a district extending from Talca in the north to Chiloe in the south* — *Ship and Engineer Surveyor* (Address, Avda. P. de Valdivia; Casilla 245) — *J. E. Alfaro (TELEGRAMS, *Alfregister*)

VALPARAISO — *Ship and Engineer Surveyor* (Address, Casilla 148) — *W. Wallace (TELEGRAMS, *Airdrie*)

NORTH AFRICA.

ALGIERS — *Ship and Engineer Surveyor* (Office, 29, Boulevard Carnot) — *Dewar Paton (TELEGRAMS, *Register*)

EGYPT AND RED SEA.

ADEN — *Ship and Engineer Surveyor* (Address, Hedjuff) — *G. H. Nunn (TELEGRAMS, *Lloydsur*)

ALEXANDRIA — *Ship and Engineer Surveyor* (Address, "Al Bassir" Building, first floor, Avenue de la Reine Nazli; P.O. Box 2121) — *H. Bishop (TELEGRAMS, *Register*; TELEPHONE NOS. 432 & 840 R)

PORT SAID — *Ship and Engineer Surveyor* (Address, P.O. Box 2) — *J. Macvey (TELEGRAMS, *Macvey*; TELEPHONE No. 546)

SOUTH AFRICA.

CAPE TOWN — *Ship and Engineer Surveyor* (Thomson Watson's Building, 4, Adderley Street) — A. H. Boyle, D.S.C. *Senior Surveyor for South Africa* (TELEGRAMS *Lloydsreg*; TELEPHONE No. 2-4493)

EAST LONDON — (Address, 6, Smith Street, West Bank, East London) — *N. W. P. McLeod (TELEGRAMS, *McLeod, West Bank, East London*)

PORT ELIZABETH — *Ship and Engineer Surveyor* (Address, P.O. Box 410) — *H. McG. Richardson (TELEGRAMS, *Lloydsreg, Port Elizabeth*)

PORT NATAL — *Ship and Engineer Surveyor* (Address, Rennie's Buildings, 394, Smith Street, Durban; P.O. Box 170) — J. M. Finlayson (TELEGRAMS, *Lloydsreg, Durban*; TELEPHONE No. 24092)

MAURITIUS.

MAURITIUS — *Ship and Engineer Surveyor* (residing at Port Louis) — *K. S. Macdonald (TELEGRAMS, *Macdonald, Port Louis, Mauritius*)

INDIA, CEYLON, BURMAH, SIAM, COCHIN-CHINA, AND STRAITS SETTLEMENTS.

BANGKOK — *Ship and Engineer Surveyor* (Office, Chartered Bank Lane) — *T. H. Pollard (TELEGRAMS, *Pollard*)

BOMBAY — *Ship and Engineer Surveyor* (Office, Exchange Building, Sprott Road, Ballard Estate) — H. P. Southwell (TELEGRAMS, *Surveyor*; TELEPHONE No. 3335)

CALCUTTA — *Ship and Engineer Surveyors* (Office, 29, Dalhousie Square) — B. Peskett; E. Oxley (TELEGRAMS, *Freeboards*)

COLOMBO — *Ship and Engineer Surveyor* (Address, 23, Canal Row; Post Box No. 270) — *H. Nightingale (TELEGRAMS, *Register*; TELEPHONE No. 1694)

KARACHI — *Ship and Engineer Surveyor* (Address, Mercantile Marine Department, Custom House) — *G. S. Miskin (TELEGRAMS, *Principoff*)

PENANG — *Acting Ship and Engineer Surveyor* ... ... (Address, Office of the Surveyor of Ships) — *J. McGuffin (TELEGRAMS, *Ships*)

RANGOON — (Address, 396, Merchant Street) — *R. P. R. Taylor (TELEGRAMS, *Orion*)

SINGAPORE — *Ship and Engineer Surveyor* (Address, 2, Laidlaw Building, Battery Road) — J. Wormald, B.Sc. (TELEGRAMS, *Surveyor* TELEPHONE No. 6065); A. E. Munro (temporarily attached)

EAST INDIAN ARCHIPELAGO.

BATAVIA — ... ... (Address, Kebon Sirih, 88, Batavia, C) — * L. Buiskool (TELEGRAMS, *Buiskool, Batavia*)

MANILA, P.I., *and ports in the Philippine Islands* ... ... *Ship and Engineer Surveyor* (Address, 240, Dasmarinas, Manila) — *C. B. Nelson (TELEGRAMS, *Register*)

SABANG — ... ... (Address, Captain of the Port, Sabang) — *T. R. van Dam

SOURABAYA — *Ship and Engineer Surveyor* (Address, Simpang 4) — J. F. Vrouwes (TELEGRAMS, *Register*; TELEPHONE No. Z.2078).

HONG KONG.

HONG KONG — *Ship and Engineer Surveyor* (Office, 5, Alexandra Buildings; P.O. Box 463) — T. S. Morrison; C. R. Rowcliffe (TELEGRAMS, *Marine*; TELEPHONE No. 179)

MANCHUKUO.

DAIREN — *Ship and Engineer Surveyor* (Address, 5, Higashikonze-cho; P.O. Box 17) — J. Sim (TELEGRAMS, *Register*)

CHINA.

HANKOW — *Ship and Engineer Surveyor* (Address, 1, Racine Building, Rue Dubail, French Concession) — *F. Allan (TELEGRAMS, *Lloydsreg*)

SHANGHAI, *including Woosung, Chinkiang and Nanking* ... ... *Ship and Engineer Surveyors* (Address, Glen Line Building, 2, Peking Road) — G. Pickering; R. Lockhart (TELEGRAMS, *Register*)

TIENTSIN — *Ship and Engineer Surveyor* (Address, c/o Borrows & Co., Liddell's Buildings, Taku Road) — *R. G. Lapper (TELEGRAMS, *Seaworthy*)

TSINGTAO — *Acting Ship and Engineer Surveyor* ... ... (Address, 3, Chekiang Road; P.O. Box No. 237) — *J. F. Magill (TELEGRAMS, *Register*; TELEPHONE No. 5721)

SURVEYORS AT OTHER PORTS ABROAD—*continued.*

JAPAN.

KOBÉ

Ship Surveyors ... ... (Office, 32, Akashi-machi (Meikai Building)) — H. Jasper Cox, *Principal Surveyor for the Far East*; M. M. Parker, M.Sc. (TELEGRAMS, *Register*; TELEPHONE No. 2530 *Sannomiya*)

Ship and Engineer Surveyors — C. Macpherson, B.Sc.; A. R. Riddell; Y. Jo; M. Kamakura; Y. Hamada

Assistant Surveyors ... — S. Hoso; S. Arima

Surveyors for Steel-testing — S. Soga; T. Matsumura; F. Ibuka

NAGASAKI

Ship and Engineer Surveyors — H. D. Buchanan; T. Kunishi

Assistant Surveyor ... ... (Office, 9, Oura, Kaigan-dori; P.O. Box No. 49) — T. Takahara (TELEGRAMS, *Register*)

YOKOHAMA

Ship Surveyor ... ... — A. McGlashan

Ship and Engineer Surveyors — J. F. Nicholas; K. Kishigami

Surveyor for Steel-testing ... (Office, 50, Yamashita-cho Naka-ku; P.O. Box No. 48) — S. Sato (TELEGRAMS, *Register*)

HAKODATE

Acting Surveyor ... ... (Address, Bansei Building, 6, Higashi Hama-machi) — *Y. Shimoda (TELEGRAMS, *Register*)

AUSTRALIA AND NEW ZEALAND.

SYDNEY, N.S.W. *Ship and Engineer Surveyors* (Office, 4, Bridge Street) — A. J. McCowan, *Principal Surveyor for Australia and New Zealand*; E. L. Cartwright; J. C. Erskine; J. H. Mitchell (TELEGRAMS, *Miramar*; TELEPHONE, No. B.W.7023—*Automatic*)

71, *Fenchurch Street, London, E.C.*3.
1*st July*, 1937.

AUSTRALIA AND NEW ZEALAND—*continued.*

ADELAIDE, S. A. *Ship and Engineer Surveyor* (Address, Institute Chambers, Divett Street, Port Adelaide) — *W. D. Ackland-Horman (TELEGRAMS, *Dinwoodie*; TELEPHONE No. J 2301)

AUCKLAND, N.Z. *Ship and Engineer Surveyor* (Office, 63, Endeans Buildings, Queen Street) — *W. Richard Smith (TELEGRAMS, *Somisto*; TELEPHONE No. 43-163)

BRISBANE, QUEENSLAND, *Ship and Engineer Surveyor* (Office, Orient Line Building, Eagle Street) — T. G. Tate (TELEGRAMS, *Register*; TELEPHONE No. 4189)

CHRISTCHURCH & LYTTELTON, N.Z. *Ship and Engineer Surveyor* (Office, T. and G. Buildings, 192, Hereford Street, Christchurch) — *J. F. Taylor (TELEGRAMS, *Oileng*; TELEPHONE No. 35—088)

DUNEDIN, N.Z. *Ship and Engineer Surveyor* (Address,) — *G. W. Martin (TELEGRAMS, TELEPHONE)

FREMANTLE, W.A. ... ... *Ship and Engineer Surveyor* (Address, 3, Cliff Street) — *W. G. Davies (TELEGRAMS, *Mardav*)

LYTTELTON, N.Z. (*See* CHRISTCHURCH, N.Z.)

MELBOURNE, VICTORIA *Ship and Engineer Surveyors* (Office, New Zealand Chambers, 483, Collins Street) — B. P. Fielden; P. A. McIntyre (TELEGRAMS, *Reports*; TELEPHONE No. M.U.2486)

NEWCASTLE, N.S.W. *Ship and Engineer Surveyor* (Office, T. & G. Building, P.O. Box 64) — *E. M. Hughes (TELEGRAMS, *Sulder*; TELEPHONE, No. 1189 *Newcastle*)

PORT PIRIE, S.A., *with Port Germein and Wallaroo* ... ... (Address, P.O. Box 65, Port Pirie) — *A. J. Elms

TIMARU, N.Z. ... ... (Address, Harbour Master, Timaru; P.O. Box 76) — *H. C. White

WELLINGTON, N.Z. *Ship and Engineer Surveyor* (Address, Nathan's Buildings; G.P.O. Box 996) — *G. D. Lidgett (TELEGRAMS, *Geolidge*; TELEPHONE No. 43-624)

LLOYD'S REGISTER OF SHIPPING.

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RULES AND REGULATIONS.

Section 1. This Society, founded in 1760 and reconstituted in 1834, was established for the purpose of obtaining for the use of Merchants, Ship Owners, and Underwriters, a faithful and accurate Classification of Mercantile Shipping, and for the government of which the following Rules and Regulations have been from time to time adopted.

Section 2. A Register Book to be printed annually for the use of Subscribers, containing the names of the Ships with other useful information, and the Character assigned, where the vessels are classed by the Society; also the names, &c., of all Ships of 100 tons and upwards unclassed by this Society.

Section 4. The subscription of Public Institutions to be Twelve Guineas per annum for a single copy of the Register Book, and Seven Guineas per annum for every additional copy supplied . . . .

Section 5. In the case of all other Subscribers, including Marine Insurance Companies, the subscription to be Seven Guineas per annum for each copy . . . .

Section 6. For the convenience of Subscribers not resident in London . . . a Supplement, containing the additions to, and corrections made in, the Register Book, to be printed fortnightly, in such convenient form as to admit of its transmission by Post, so that such parties may be furnished, from time to time, with the latest and most complete information.

Section 7. The superintendence of the affairs of the Society to be under the direction of a General Committee composed of Merchants, Ship Owners, and Underwriters (twenty-four elected in London, namely, nine by the Committee of Lloyd's, twelve by the Committee of the London General Shipowners' Society, and three by the Committee of the Institute of London Underwriters, and thirty-seven at the principal Outports), and the following, namely:—Shipbuilders and/or Engineers, not exceeding ten, who may be elected by the General Committee; additional Members not exceeding twelve, who may be elected by the General Committee; past Chairmen of the Society, who may be elected by the General Committee, and the following *ex-officio* members, namely:—The Chairman, or, in his absence, the Deputy-Chairman, of the Corporation of Lloyd's; the Chairman, or, in his absence, the Deputy-Chairman, of the London General Shipowners' Society; the Chairman, or, in his absence, the Deputy-Chairman, of the Institute of London Underwriters, and the Chairman of each Branch Committee established abroad.

Any member (except an *ex-officio* member, or a member elected by the General Committee) who fails to attend any meetings of the General Committee for a period of six consecutive months, without leave of absence, shall cease to be a member, and his place shall be filled up in the usual way.

Section 15. No Member of the Committee to be permitted to be present on the decision of the classification of any ship of which he is the owner, or wherein he is directly, or indirectly interested.

Section 16. 1. The Committee to be empowered to make such Bye-laws for their own government and proceedings as they may deem requisite, not being inconsistent with the original Rules and Regulations under which the Society was established ; but no new Rule or Bye-law to be introduced or any Rule or Bye-law altered, without special notice being given for that purpose at the Meeting of the Committee next preceding that at which such Motion is intended to be made ; such notice to be inserted in the summons convening the meeting.

2. No new Rule, or alteration in any existing Rule materially affecting the classification of Ships, to be applied compulsorily to vessels of which the plans have been submitted and approved before the expiration of six months after the date when the change has been adopted.

Section 17. 1. That sixteen representatives of Shipbuilders, Engineers, Steel Makers, and Forgemasters shall be admitted as members of the Technical Sub-Committee on all occasions when it is proposed to make alterations in the existing rules, or to frame new rules, for the construction of ships or machinery.

2. That twelve representatives of Shipbuilders and Engineers shall be elected by the following bodies, viz. :

(*a*) The Institution of Naval Architects, London ;

(*b*) The North-East Coast Institution of Engineers and Shipbuilders, Newcastle-on-Tyne ; and

(*c*) The Institution of Engineers and Shipbuilders in Scotland, Glasgow,

two shipbuilders and two engineers being elected by each body ;

That two representatives of Steel Makers be elected by the Iron and Steel Institute, of whom one is to represent England and Wales, and the other Scotland ; also

That two representatives of Forgemasters be elected, one by the English and Scottish Forgemasters' Association and one by the Federated Forgemasters.

3. That the representatives shall be elected for a term of four years, but in the event of any vacancy occurring before the expiration of this period a representative may be elected to fill the vacancy for the unexpired portion of the term.

4. That those only who are actually partners in firms, or managers of joint stock companies, engaged in Shipbuilding, Engineering, Steelmaking, or the Manufacture of Forgings, shall be eligible for election.

5. That, in addition to the sixteen representatives referred to in Clause 1, one representative shall be elected by each of the following bodies, viz. :

(*a*) The Honourable Company of Master Mariners ;

(*b*) The Institute of Marine Engineers ;

and

(*c*) The Society of Consulting Marine Engineers and Ship Surveyors.

6. That each Branch Committee of Lloyd's Register established abroad shall be entitled to nominate one of its Members as a representative at Meetings of the Technical Sub-Committee.

7. That additional members of the Technical Sub-Committee, not exceeding four, may be elected by the General Committee.

Section 18. All Reports of survey to be made in writing by the Surveyors according to the form prescribed, and submitted for the consideration of the General Committee, or of the Sub-Committees of Classification ; but the character assigned by the latter to be subject to confirmation by the General Committee.

Section 19. 1. The reports of the Surveyors (and all documents and proceedings) relating to the classification of ships are to be carefully preserved and shall, subject to the approval, in his absolute discretion, of the Chairman, or the Deputy-Chairman, or the Chairman of the Sub-Committees of Classification, be open to the inspection of the Owner and of any other person authorised in writing by the Owner.

2. Copies of the original reports (if the ships be already classed, but not otherwise), so far as relates to the dimensions, scantlings, fastenings, and materials, in cases where the correctness of the reports in these particulars is certified by the builders, are granted on application.

Section 22. 1. When the Surveyors consider repairs to be requisite, they are respectfully to communicate the same in writing to the Owner, Master, or Agent, and if such repairs be not entered upon within a reasonable time, a corresponding report is to be made, as soon as possible, to the Committee for their decision thereon.

2. All repairs of Ships or Machinery required at Ports where there is a Surveyor to this Society, in order to their obtaining a Character in the Register Book, or to their retaining the Characters assigned to them therein, must be carried out under the inspection, and to the satisfaction of the Society's Surveyors. Ships or machinery repaired at Ports where there is no Surveyor to this Society must be surveyed by one of the Society's Surveyors at the earliest opportunity.

Section 23. Parties considering the repairs suggested by the Surveyor to be unnecessary or unreasonable may appeal to the Committee, who will direct a special survey to be held ; but should the opinion of the Surveyor be confirmed by the Committee, then the expense of such special survey is to be paid by the party appealing.

Section 24. The Surveyors to the Society not to be permitted (without the especial sanction of the Committee) to receive any fee, gratuity, or reward whatsoever for their own use or benefit, for any service performed by them in their capacity of Surveyors to this Society, on pain of immediate dismissal.

Section 25. The Surveyors will be directed to attend on Special Surveys of ships or machinery while building or under damage or repair, when required by Merchants, Shipowners, or Underwriters ; the charge for which is to be regulated according to the nature and extent of the service performed. In all cases, the application for the assistance of the Surveyors must be made in writing addressed to the Secretary.

Section 26. While the Committees of the Society use their best endeavours to ensure that the functions of the Society are properly executed, it is to be understood that neither the Society nor any Member of any of its Committees is under any circumstances whatever to be held responsible for any inaccuracy in any report or certificate issued by the Society or its Surveyors, or in any entry in the Register Book or other publication of the Society, or for any error of judgment, default or negligence of any of its Committees or any Member thereof, or the Surveyors, or other Officers or Agents of the Society.

FUNDS.

Section 28. The following Fees to be charged to the Owners of ships prior to their vessels being classed and registered in the book :—

Classing Fees.

For First Entry of Class in the Register Book.

For each Ship under 250 tons gross									£2	0	0
„	of	250	and under	500	tons gross				3	0	0
„	„	500	„	1,000	„				4	0	0
„	„	1,000	„	2,000	„				5	0	0
„	„	2,000	„	3,000	„				6	0	0
„	„	3,000	„	4,000	„				7	0	0
„	„	4,000	„	5,000	„				8	0	0
„	„	5,000	„	6,000	„				9	0	0
„	„	6,000	„	8,000	„				10	0	0
„	„	8,000	„	10,000	„				11	0	0
„	„	10,000 tons gross and upwards							12	0	0

For First Entry of Notification of "LMC" in the Register Book.

For each Ship under 100 nominal HP									£2	0	0
„	of	100	and under	200	nominal HP...				3	0	0
„	„	200	„	300	„ HP...				4	0	0
„	„	300	„	500	„ HP...				5	0	0
„	„	500 nominal HP and above							6	0	0

SPECIAL SURVEYS.

Section 29. 1. For ships built under the special superintendence of the Surveyors (to entitle them to the distinctive mark ✠) :—2s. per ton for the first 1,500 tons gross ; 1s. per ton for every ton from 1,501 tons to 5,000 tons gross ; 6d. per ton for every ton from 5,001 tons to 10,000 tons gross ; and 3d. per ton for every ton from 10,001 tons to 25,000 tons gross. A special fee, to be arranged, will be charged in the cases of vessels of over 25,000 tons gross. No fee to be less than £20.

50 per cent. to be added to these fees for the Special Survey during construction of vessels for Carrying Oil in Bulk.

2. For engines and boilers built under the special superintendence of the Surveyors (to entitle them to the distinctive mark ✠ in red) :—5s. per nominal horse-power for the first 250 horse-power ; 3s. for each horse-power from 251 to 500 ; 1s. for each horse-power from 501 to 1,000 ; and 6d. for each horse-power from 1,001 to 5,000. A special fee, to be arranged, will be charged in the cases of engines and boilers of over 5,000 nominal horse-power. No fee to be less than £15.

The following rule is to be used for determining the Nominal Horse-Power of Steam Reciprocating Engines in regulating the fees for their survey, viz. :—

$$NHP = \frac{P + 23,9}{70,3}\left(\frac{D^2\sqrt{S}}{1028} + 0,72\ H\right)$$ where the boiler pressure is below 11,25 kgs. per cm².

$$= \frac{P + 41,5}{105,5}\left(\frac{D^2\sqrt{S}}{1028} + 0,72\ H\right)$$ where the boiler pressure is 11,25 kgs. per cm². or above.

For determining the Nominal Horse-Power of Steam Turbine Engines $\frac{S\ H\ P}{6}$ is to be substituted in the above formulæ for $\frac{D^2\ \sqrt{S}}{1028}$, where S.H.P. is the Total Shaft Horse-Power.

If the boilers are fitted with Forced Draught or Induced Draught appliances, then 0,90 H is to be taken instead of 0,72 H.

where D = diameter of L.P. Cylinder in centimetres,
S = stroke in centimetres,
H = heating surface in square metres,
P = working pressure in kilogrammes per cm².

The square metres of heating surface represented by H will comprise the total surface of those parts of the boiler exposed to heat so as to cause evaporation.

The following rule is to be used for determining the Nominal Horse-Power of Heavy Oil Engines in regulating the fees for their survey, viz. :—

$$NHP = \frac{C \times N \times D^2}{\frac{S}{D} + 50}$$

where NHP = the Nominal Horse-Power.
N = the number of power cylinders.
D = the diameter of the power cylinders in millimetres.
S = the stroke of the piston in millimetres. In the case of the opposed piston type of Engines S is half the combined stroke of the pistons.
C = 0,00775 for Engines of the 4S.C.S.A. type.
= 0,0155 for Engines of the 4 S.C.D.A. type.
= 0,0140 for Engines of the 2 S.C.S.A. type.
= 0,0280 for Engines of the 2 S.C.D.A. type.
= 0,0248 for Engines of the 2 S.C.S.A. opposed piston type

The following rule is to be used for determining the Nominal Horse-Power of Petrol and Paraffin Engines in regulating the fees for their survey, viz. :—

$$N.H.P. = \frac{B.H.P}{3{\cdot}5}$$ where B.H.P. is the Brake Horse-Power at full power.

For the survey and testing of each riveted air receiver the following fees will be charged :—

For each riveted air receiver up to 5500 litres capacity	£2 2 0
For each riveted air receiver over 5500 and up to 8500 litres capacity ...	3 3 0
For each riveted air receiver over 8500 litres capacity...	4 4 0

Where seamless air receivers are made at works other than those at which the engines are constructed, a fee of 10s. 6d. per receiver will be charged, provided that in no case shall the fee charged be less than £1 1s. per ship.

For the survey and testing of steam boilers fitted in Motorships, additional fees will be charged in accordance with the Society's usual scale.

For the survey during construction of welded engine bedplates and entablatures the following fees will be charged :—

Main Engines up to 100 Nominal Horse-Power	£ 4 4 0
Main Engines from 100 to 250 Nominal Horse-Power	8 8 0
Main Engines over 250 Nominal Horse-Power	12 12 0
Auxiliary Engines	3 3 0

In the case of engines having welded bedplates only, half the above fees should be charged.

3. For electric generators, motors and control gear to be used for propelling purposes, and built under the special superintendence of the Surveyors in conjunction with the special survey of engines and boilers (to entitle them to the distinctive mark ✠ in red) :—

Four shillings per N.H.P. for the first 500 horse-power ; one shilling for each horse-power from 501 to 1,000 ; and sixpence for each horse-power beyond 1,000.

No fee to be less than £15.

This fee is in addition to the engine and boiler fees.

Travelling and subsistence expenses, if any, to be charged in addition to the survey fee.

The following rule is to be used for determining the N.H.P. of electric propelling machinery in regulating the fees for their survey, viz. :—

$$\text{N.H.P.} = \frac{\text{S.H.P.}}{6}$$

where S.H.P. is the total shaft horse-power of the propelling motors at their maximum continuous rating.

In the case of double-ended vessels having propelling motors driving separate screwshafts at each end

$$\text{N.H.P.} = \frac{\text{S.H.P.}}{9}$$

is to be substituted for the foregoing formula, where S.H.P. is the total shaft horse-power of all the propelling motors at their maximum continuous rating.

Where power for excitation is taken from the ship's auxiliary lighting and power generators and is an appreciable proportion of the total developed kilowatts, the power absorbed for this duty at maximum continuous rating may be deducted from the auxiliary generator capacity for determining the fees for the inspection of the installation of auxiliary electrical equipment.

In cases in which excitation machines, or auxiliary generators under 100 k.w. capacity from which power for excitation is taken, are being constructed at works other than those at which the electric propelling machinery is being built, requiring additional visits from the Surveyors, an extra fee for the inspection and testing of these machines is to be charged, viz :—£2 2s. 0d. per visit if the Surveyor's time is not occupied beyond three hours, or £4 4s. 0d. per visit per day if the Surveyor's time is occupied more than three hours. Travelling and subsistence expenses, where incurred, are to be charged in addition.

4. For the survey and testing of each vertical Donkey Boiler, a fee of four guineas will be charged.

5. For the survey and testing of press boilers and similar apparatus for floating whale-oil factories, a fee of £2 per boiler or apparatus will be charged.

6. For the survey of damage repairs essential to the continuation of class (whether a special damage report be required or not), for the survey of repairs due to wear and tear when they are of an extensive character, for surveys with a view to the re-instatement of class, and for the survey of alterations in the structure of a vessel, a fee will be charged according to the nature and extent of the services performed.

For all surveys held at ports abroad a fee will be chargeable according to the nature and extent of the services rendered.

10. In all cases where travelling expenses are incurred by the Surveyors in connection with the above services, they are to be defrayed by the parties interested in the same.

Section 30. The class of a vessel is liable to be withheld, or, if already granted, may be withdrawn or expunged from the Register Book in the case of non-payment of any fees or expenses chargeable on account of such vessel.

Section 31. Certificates of Classification, signed by the Chairman, Deputy-Chairman, or Chairman of the Sub-Committees of Classification, and countersigned by the Secretary, will be granted on application.

Section 33. Rules for Steel Ships, 15s.; if for Wood Ships and Composite Ships, 5s.

London, 18th February, 1937.

GENERAL REGULATIONS

RELATING TO THE

CLASSIFICATION OF STEEL VESSELS.

1. Classification. (*a*) *General.*—Steel vessels built in accordance with the Society's Rules and Regulations, or with alternative arrangements equivalent thereto, will be classed so long as they are found upon careful annual and periodical survey to be in a fit and efficient condition for the safe conveyance of dry and perishable cargo.

(*b*) *Class* 100A.—This class will be assigned to steel vessels built in accordance with the Society's Rules and Regulations and the scantlings set forth therein for vessels having the maximum draught permitted by the dimensions.

(*c*) *Class* 100A *"With Freeboard."*—This class will be assigned to steel vessels built in accordance with the Society's Rules and Regulations and the scantlings set forth therein for vessels having less than the maximum draught permitted by the dimensions, or such modification in these scantlings as may be approved in any special case by the Committee with the written consent of the owners.

(*d*) *Class* 100A *"Carrying Petroleum in Bulk."*—This class will be assigned to steel vessels built in accordance with the "Rules for the construction of vessels intended to carry petroleum in bulk." Where departures from these Rules are permitted on account of the nature of the cargo and other circumstances the class may be suitably modified. A special notation will be added to indicate the system of construction adopted.

(*e*) *Class* 100A *"For Special Service."*—Vessels in which the scantlings are equivalent to the general requirements of the Rules and the special tables for such vessels may be classed 100A, with a notation showing the particular service in which they are engaged, as—100A "Dredger."

(*f*) *Class* A *"For Special Service."*—Vessels intended for special services may receive the class A without a numeral prefixed, provided the details of the scantlings and arrangements are approved by the Committee. Where the vessel is intended for other than river or inland water service the class will be—"With Freeboard."

To the class A will be affixed notations showing the particular services for which the vessels are intended, such as "For river services"; "For towing services"; "For Channel services" and "For coasting services."

In the case of vessels intended for channel and coasting services, the particular Channel and geographical limits of coasting will be defined, *e.g.*, "Bristol Channel"; "Newhaven-Dieppe" and "Buenos Aires and Monte Video."

(*g*) *Notation for Ice Strengthening:*—Where a special notation "Strengthened for Navigation in Ice" is desired, additional strengthening is to be fitted in accordance with **Section 40.**

(*h*) *Equivalent Arrangements.*—Deviations from the Rules will be allowed provided they are submitted to the Committee and considered by them to be equivalent to the requirements of the Rules.

The builder shall obtain the owner's sanction to such deviations when the Committee deem it to be necessary.

2. Submission of Plans.—Where it is intended to build vessels for classification in the Register Book, plans of midship section and profile with deck and other plans showing the proposed dimensions, scantlings and arrangements, are to be submitted by the Builders through the local Surveyors for the approval of the Committee.

3. Proper Loading of Vessels.—The scantlings and arrangements given in the Rules are not framed to provide for any special concentration of loading, and if such is proposed to be adopted the Committee may require additional strengthening to be fitted.

Where an owner desires the Committee to make provision for exceptional ballast or loaded conditions, arrangements should be made so that the necessary particulars be given on the plans when these are submitted for approval.

4. Special Survey during Construction.—Vessels intended for classification in the Register Book are to be built under the Society's Special Survey and vessels so built will be entitled to the distinctive mark ✠ in the Register Book.

During the progress of construction, from the laying of the keel to the completion of a vessel, it is the duty of the Surveyors to examine the material and workmanship in order to ensure that the requirements of the Rules and the approved plans are satisfactorily carried out. The Surveyors are required to point out as early as possible anything that is objectionable, or that is not in accordance with the Rules or with the plans approved by the Committee for the particular vessel.

5. Equipment.—The figure 1 placed after the character assigned to a vessel indicates that the anchors, cables, and hawsers of a vessel are in good and efficient condition and are in accordance with the requirements of the Rules.

In the case of vessels classed "For Special Services," the figure 1 indicates that the equipment is considered by the Committee to be sufficient for the particular service in which the vessel is to be engaged.

In cases in which the requirements of the Rules as to equipment have not been complied with, or in which the equipment is found to be insufficient in quantity or defective in quality, a line will be inserted in place of the figure 1, thus 100A–.

6. Main and Auxiliary Engines and Boilers. *General.*—The main and auxiliary engines and boilers of vessels intended for classification, or already classed, in the Register Book, are to be constructed under the Society's Special Survey. Appropriate records will be made in the Register Book *in red*, such as ✠LMC6,35 (Lloyd's Machinery Certificate, June, 1935), or ✠NE&B6,35 (New Engines and Boilers, June, 1935), or ✠NE6,35, or ✠NB6,35.

7. Novel Forms of Construction.—Where the proposed construction of a vessel or of the engines or boilers is novel in design or involves the use of unusual material, and where experience has not sufficiently justified the principle or mode of application involved, the notation "Experimental" will be inserted under the class of the vessel in the Register Book, where the Committee consider such a course is desirable.

If, in the opinion of the Committee, the engines or boilers are so inefficient as to imperil the vessel's safety, no class will be assigned to the vessel.

8. Date of Build.—The date of completion of the Special Survey of vessels built under the Society's inspection will be taken as the date of build.

9. Vessels not Built under Survey.—The requirements of the Committee for the classification of vessels which have not been built under the Society's Survey are set forth in the Rules.

10. Periodical Special Surveys. (*a*) *General.*—To entitle steel vessels to retain the characters assigned to them in the Register Book, they are required to be subjected to the Periodical Special Surveys, designated No. 1, No. 2, and No. 3, in accordance with the requirements of the Rules. These surveys become due at 4 years, 8 years, and 12 years respectively from the date of build, and subsequently at the expiration of like periods from the date of the previous Special Survey No. 3 as recorded in the Register Book.*

* Vessels built prior to 1923 and classed A "For Special Service" will be due for Special Survey at a period of four years from the date of the previous Special Survey, until the next Special Survey No. 3 is held.

In any case in which a vessel upon completion is not immediately put into commission, but is laid up for a period, the Committee, upon application by the owner, prior to the vessel's proceeding to sea, may direct an examination of the vessel to be made in dry dock by the Society's Surveyors, and if as the result of such survey the vessel as regards hull, engines, boilers and equipment (including boats) be reported in all respects free from deterioration, the periodical surveys shall become due at periods of 4, 8, and 12 years respectively from the date of such examination.

Should a vessel at any time be submitted to Special Survey No. 3 before this becomes due, the Special Surveys subsequently required will be Nos. 1, 2, and 3 at 4 years, 8 years, and 12 years respectively from the date of such Special Survey No. 3 as recorded in the Register Book.

(*b*) *Surveys held in anticipation.*—In cases in which it may suit the convenience of the owners, the Special Surveys Nos. 1 and 2 may be held at any time within 12 months previous to the dates at which they severally become due, and the Special Survey No. 3 may be held at any time before the date at which it becomes due.

(*c*) *Period allowed for completion of Surveys.*—In cases where it is inconvenient for owners to fulfil all the requirements of any of the Periodical Special Surveys at the prescribed time, part only of the survey need then be carried out, provided the remainder of the survey be completed within twelve months from the date at which it became due. When a Special Survey is only partly held, the Surveyors must give the owners, or their agents, written notice of the parts not surveyed, and report the facts to the Committee.

(*d*) In the case of vessels carrying petroleum in bulk, the Committee will be prepared, at the request of the owner, to sanction the examination and testing of the oil compartments so that all the compartments are examined and tested every four years and that the period which elapses between consecutive examinations and testing of each compartment shall not exceed four years.

In such cases the certificate of classification will be endorsed "Progressive Survey of Oil Tanks" and this notation will also be printed in the Register Book.

The date of survey recorded in the Register Book will be the date on which the principal part of the requirements for Special Periodical Surveys is complied with.

(*e*) *Occasional Surveys.*—All vessels are subject to Annual, or Occasional Surveys when practicable. The requirements in respect of such surveys are set forth in the Rules.

(*f*) *Record of Periodical Special Surveys in Register Book.*—Vessels which have satisfactorily passed any of the Periodical Special Surveys will have notations made against their names in the Register Book indicating the survey and the date at which it was held thus :—*ss*No.1–15, *ss*No.2–19, *ss*No.3–6,23, 2nd*ss*No.3–6,35. Where Special Surveys are not completely carried out at one time, the date of Special Survey recorded in the Register Book will be the date of the survey at which the principal part of the requirements is complied with.

(*g*) *Main and Auxiliary Engines and Boilers.*—The main and auxiliary engines and boilers are to be submitted to periodical survey as required by the Rules.

11. Surveys of Repairs.—All repairs of vessels, engines and boilers that may be required in order that the vessels may retain their character in the Register Book, must be carried out under the inspection and to the satisfaction of the Society's Surveyor when one is stationed in the district. When such repairs are effected at a port where there is no Surveyor to this Society, the vessel must be surveyed by one of the Society's Surveyors at the earliest opportunity.

When the Surveyors consider repairs necessary, they are respectfully to communicate their recommendations in writing to the owner, master, or agent; and, if such repairs be not undertaken within a reasonable time, a report is to be made as soon as possible to the Committee.

12. Notice of Surveys.—The Society's Surveyors are required to attend for the purpose of holding surveys in their district, but the duty of giving notice when the attendance of the Surveyors is required to carry out Periodical Special Surveys or to supervise repairs, rests with the owners, masters, or agents. If such notice is not given, and the requisite surveys are not carried out, the characters of vessels are liable to be expunged from the Register Book.

13. Appeal from Surveyor's Recommendations.—Interested parties, considering the recommendations of the Society's Surveyors, as to the construction or repair of a vessel, to be in any case unnecessary or unreasonable, are entitled to appeal to the Committee, who will direct a special survey to be held; but should the opinion of the Surveyor be confirmed by the Committee, the expense of such special survey is to be paid by the party appealing.

14. Certificates of Class. (*a*) *General.*—Certificates of first entry of classification and certificates of character upon subsequent completed surveys on vessels, engines, and boilers, signed by the Chairman, the Deputy-Chairman, or the Chairman of the Sub-Committees of Classification, and countersigned by the Secretary, will be granted on application.

(*b*) *Provisional Certificates.*—If the hull of a vessel has been built in accordance with the Rules, and a satisfactory report has been received from the Society's Surveyors, a provisional certificate will be issued, if desired, stating the class to which the vessel will be entitled when the engines and boilers have been fitted on board in accordance with the Rules, and the Committee's requirements otherwise complied with.

15. Reconsideration of Class.—If, upon survey of any vessel, a material reduction is found to have taken place in the thickness of the plating and angles, the classification of the vessel will be reconsidered by the Committee. In every case in which the class assigned to a vessel is proposed to be reduced, notice is to be given in writing to the owner, master, or agent, with an intimation that if the reduction be objected to, the Committee will be ready to direct a special survey, if the owner, master, or agent agrees to pay the expenses attending the same, provided on the same special survey there shall appear sufficient ground for the proposed reduction of Class.

16. Withdrawal of Class. (*a*) *Non-compliance with Rules.*—When the Rules as regards surveys on the hull, engines or boilers of a steam or motor vessel, or on the hull, masts, spars, or rigging of a sailing vessel have not been complied with, so that the vessel is not entitled to retain her class in the Register Book, the character will be expunged with a red line, under which the date of such withdrawal will be recorded.

(*b*) *Reported defects.*—When it is found from reported defects in the hull, engines or boilers of a steam or motor vessel, or in the hull, masts, spars, or rigging of a sailing vessel, that the vessel is not entitled to retain her class in the Register Book, the character will be expunged with a black line, under which the date of such withdrawal will be recorded.

(*c*) *Owner's request.*—When the class of a vessel is withdrawn from the Register Book by the Committee in consequence of a request from the owner, this will be indicated by the insertion of three dots (...) in the Register Book.

(*d*) *Infringement of freeboard conditions.*—Where any vessel proceeds to sea with a less freeboard than that approved by the Committee, or where the freeboard mark is placed higher on the vessel's sides than the position assigned by the Committee, the vessel's class will be liable to be expunged from the Register Book.

PERIODICAL SURVEYS OF STEEL VESSELS.

SPECIAL SURVEY No. 1.

1. The vessel is to be placed on blocks of sufficient height in a dry dock, or on a slipway; proper stages are to be made, and the holds and peaks are to be cleared for examination.

2. In vessels having a single bottom the limber boards and ceiling equal to not less than two strakes fore and aft on each side are to be removed, one such strake being taken from the bilges. Where the ceiling is fitted in hatches, the whole of the hatches and one strake of ceiling at the bilges are to be removed.

3. The coal bunkers of steam vessels are to be cleared for examination, and ceiling is to be removed as in the holds. The bilges and limbers all fore and aft are to be cleaned out, so as to allow of these parts being properly examined.

4. The framing and both surfaces of shell plating are to be exposed, and cleaned and coated where necessary. Special attention should be given to the examination of the ash shoots, and the shell plating in way of the openings.

5. In cases in which the inner surface of the bottom plating is coated with cement or asphalt, the removal of this coating may be dispensed with, provided it be carefully inspected, tested by beating or chipping, and found sound and adhering satisfactorily to the steel.

6. If the vessel has a double bottom a sufficient amount of ceiling is to be removed to enable the condition of the tank top to be ascertained, and if it is found that the plating is free from dirt and rust, the removal of the remainder of the ceiling may, in the case of the First Special Survey, be dispensed with.

7. The double bottom tanks are to be tested by a head of water to the light water-line, but in no case less than 2,45 m. above the inner bottom. Double bottom compartments, which are used for the carriage of oil fuel, are to be tested by a head of water extending to the load water-line, or by a head sufficient to give the maximum pressure which can come upon them in practice, whichever is the greater.

Where peak tanks or other deep tanks for carrying water ballast are fitted, their watertightness is to be tested by a head of water not less than 2,45 m. above the crown of the tank.

All water ballast tanks are to be cleaned out to admit of their being properly examined inside, special attention being given to the tanks under the boilers.

All peak tanks, deep tanks and bunkers specially constructed for carrying oil fuel are to be examined internally and are to be tested by a head of water equal to 30 per cent. of the depth of the tank, or 2,45 m., whichever is the greater, provided the tanks are fitted with overflows or other means to prevent a greater pressure than indicated above. Where the tanks are not fitted with overflows or other similar devices, they must be tested by a head sufficient to give the maximum pressure which can be experienced in practice.

In the case of motor and other vessels burning oil fuel and carrying it in the double bottom and other tanks, upon the occasion of the First Special Survey No. 1 these tanks, with the exception of the fore and aft peak tanks, need not be examined internally, provided upon a general external examination of the tanks the Surveyor finds their condition to be satisfactory. In these cases the tanks are to be tested by a head of water of not less height than that stated in the preceding paragraph.

8. When a deck originally required to be 75 mm. thick is worn to 65 mm., 65 mm. to 50 mm., it is to be renewed. If, however, such deck is found on survey to be in good condition the case will, upon application, receive the consideration of the Committee.

9. The masts, spars, rigging, anchors, and general equipment of steam and sailing vessels are to be examined and either found, or placed, in good and efficient condition.

10. The hatch covers and supports throughout are to be examined in position at the hatchways, and, if defective, are to be renewed or made good.

The Surveyors should report on the efficiency of the tarpaulins, cleats, and battens, or other means of securing the hatches.

The ventilator coamings and covers are to be examined, and special care is to be taken to see that they are in an efficient condition.

11. The rudder, quadrant, tiller, steering gear, engine, and its connections and telemotor gear are to be examined.

Special attention is to be paid to the examination of all parts of rod and chain gears. All pins are to be examined and the chain is to be cleaned and examined for wear and tear. Any length of chain so worn that its mean diameter at its most worn part is reduced to the size in the Table, as given in the **Rules for Annual or Occasional Surveys,** is to be renewed.

The various parts of the auxiliary steering gear are to be examined in order to ascertain that the gear is in a good and workable condition.

All replacements of chains are to be subjected, under the Society's supervision, to the proof tests as set forth for short link cables in **Section 14** of the **Rules for Quality and Testing of Materials,** and the certificates are to be produced. It is recommended that, in addition, the breaking test as required in **Section 14** mentioned above should also be applied to these chains, and that the tests be made at a proving establishment recognised by the Committee.

It is recommended that repaired chains be tested by the repairers and a certificate to that effect be produced.

It is recommended that a set of spares as required by **Section 33, clause 5** of the Rules be provided.

12. The windlass, pumps, sluice valves, watertight doors, and air and sounding pipes are to be carefully examined.

The Surveyor is to see that doubling plates are fitted under all sounding pipes.

13. Where holds are insulated for the purpose of carrying frozen or chilled meat, and the vessel in way of the insulation was examined by the Society's Surveyors at the time such insulation was fitted, it will be sufficient at the first Special Survey No. 1 to remove the limbers and hatches to enable the plating to be examined.

14. The freeboard recorded in the Register Book is to be verified.

15. The main and auxiliary engines and boilers and electrical equipment are to be examined and favourably reported on by the Society's Engineer Surveyors.

For Periodical Surveys of main and auxiliary engines and boilers and electrical equipment see pages 19–23.

Second and Subsequent Surveys No. 1.

1. All the requirements of Special Survey No. 1 are to be complied with.

2. In vessels having double bottoms, the inner bottom plating is to be examined and to enable this to be done the close ceiling is to be removed, but if it is found after removal of portions of the ceiling that the steel work is in good condition, free from rust, and coated, the removal of the whole may be dispensed with. In vessels having single bottoms, a sufficient amount of ceiling is to be removed to enable the structure below the ceiling to be examined.

In insulated holds, the limbers and hatches are to be removed and enough insulation is to be removed to admit of the framing and plating being examined.

3. All the double bottom tanks are to be examined internally.

4. The plating in way of the sidelights is to be examined, and if the Surveyor deems it necessary, he may require holes to be drilled in any portion of the structure where signs of wastage are evident, in order to ascertain the thickness of the material.

5. The chain cables are to be ranged for inspection, and the anchors and chains are to be examined and placed in good working condition. If any length of chain cable is found to be reduced in mean diameter at its most worn part to the extent indicated in **Table 56**, it is to be renewed.

6. The chain locker is to be examined internally.

7. All mast and bowsprit wedging is to be removed, except where the plating of masts or bowsprits is doubled in way of the wedging.

SPECIAL SURVEY No. 2.

1. The vessel is to be placed on blocks of sufficient height in a dry dock or on a slipway; proper stages are to be made, and the holds and peaks are to be cleared for examination.

2. In vessels having a single bottom, the limber boards and ceiling equal to not less than three strakes fore and aft on each side are to be removed, one such strake being taken from the bilges.

Where the ceiling is fitted in hatches, the whole of the hatches and one strake of ceiling at the bilges are to be removed.

3. The coal bunkers of steam vessels are to be cleared for examination, and ceiling is to be removed as in the holds. The bilges and limbers all fore and aft are to be cleaned out, so as to allow of these parts being properly examined.

4. The framing and both surfaces of the shell plating are to be exposed, and cleaned and coated where necessary. Special attention should be given to the examination of the ash shoots and the shell plating in way of the openings.

5. In cases in which the inner surface of the bottom plating is coated with cement or asphalt, the removal of this coating may be dispensed with, provided it be carefully inspected, tested by beating or chipping, and found sound and adhering satisfactorily to the steel.

6. If the vessel has a double bottom, an additional amount of ceiling is to be removed to enable the condition of the inner bottom plating, stanchion feet, and the bottom plating of bulkheads and tunnel sides to be examined. If the Surveyor deems it necessary, the whole of the ceiling is to be removed.

7. The double bottom tanks are to be tested by a head of water to the light water-line, but in no case less than 2,45 m. above the inner bottom. Double bottom compartments, which are used for the carriage of oil fuel, are to be tested by a head of water extending to the load water-line, or by a head sufficient to give the maximum pressure which can come upon them in practice, whichever is the greater.

Where peak tanks or other deep tanks for carrying water ballast are fitted, their water-tightness is to be tested by a head of water not less than 2,45 m. above the crown of the tank.

All double bottom tanks are to be cleaned out, to admit of their being properly examined inside, special attention being given to the tanks under the boilers.

All peak tanks, deep tanks and bunkers specially constructed for carrying oil fuel, are to be examined internally and are to be tested by a head of water equal to 30 per cent. of the depth of the tank, or 2,45 m., whichever is the greater, provided the tanks are fitted with overflows or other means to prevent a greater pressure than indicated above. Where the tanks are not fitted with overflows or other similar devices, they must be tested by a head sufficient to give the maximum pressure which can be experienced in practice.

8. The plating in way of the sidelights is to be examined, and if the Surveyor deems it necessary he may require holes to be drilled in any portion of the structure where signs of wastage are evident, in order to ascertain the thickness of the material.

9. When a deck originally required to be 75 mm. thick is worn to 65 mm., 65 mm. to 50 mm., it is to be renewed. If, however, such deck is found on survey to be in good condition, the case will, upon application, receive the consideration of the Committee.

10. The chain cables are to be ranged for inspection, and the anchors and chains are to be examined and placed in good working condition. If any length of chain cable is found to be reduced in mean diameter at its most worn part to the extent indicated in **Table 56**, it is to be renewed.

11. The chain locker is to be examined internally.

12. The masts, spars, rigging and general equipment are to be examined and either found, or placed, in good and efficient condition.

13. The hatch covers and supports throughout are to be examined in position at the hatchways, and, if defective, are to be renewed or made good.

The Surveyors should report on the efficiency of the tarpaulins, cleats and battens, or other means of securing the hatches.

The ventilator coamings and covers are to be examined, and special care is to be taken to see that they are in an efficient condition.

14. The rudder, quadrant, tiller, steering gear, engine, and its connections and telemotor gear are to be examined.

Special attention is to be paid to the examination of all parts of rod and chain gears. All pins are to be examined and the chain is to be cleaned and examined for wear and tear. Any length of chain so worn that its mean diameter at its most worn part is reduced to the size in the Table, as given in the **Rules for Annual or Occasional Surveys**, is to be renewed.

The various parts of the auxiliary steering gear are to be examined in order to ascertain that the gear is in good and workable condition.

All replacements of chains are to be subjected, under the Society's supervision, to the proof tests as set forth for short link cables in **Section 14** of the **Rules for Quality and Testing of Materials**,

and the certificates are to be produced. It is recommended that, in addition, the breaking test as required in **Section 14** mentioned above should also be applied to these chains, and that the tests be made at a proving establishment recognised by the Committee.

It is recommended that repaired chains be tested by the repairers and a certificate to that effect be produced.

It is recommended that a set of spares as required by **Section 33, clause 5** of the Rules be provided.

15. The windlass, pumps, sluice valves, watertight doors, and air and sounding pipes are to be carefully examined.

The Surveyor is to see that doubling plates are fitted under all sounding pipes.

16. Where holds are insulated for the purpose of carrying frozen or chilled meat, and the vessel in way of the insulation was examined by the Society's Surveyors at the time such insulation was fitted, it will be sufficient at the first Special Survey No. 2 to remove the limbers and hatches to enable the plating to be examined.

17. The Freeboard recorded in the Register Book is to be verified.

18. The main and auxiliary engines and boilers and electrical equipment are to be examined and favourably reported on by the Society's Engineer Surveyors.

For Periodical Surveys of main and auxiliary engines and boilers and electrical equipment see pages 19–23.

Second and Subsequent Special Surveys No. 2.

1. All the requirements of Special Survey No. 2 are to be complied with.

2. In vessels having double bottoms, the inner bottom plating is to be examined and to enable this to be done the close ceiling is to be removed, but if it is found after removal of portions of the ceiling that the steel work is in good condition, free from rust, and coated, the removal of the whole may be dispensed with. In vessels having single bottoms, a sufficient amount of ceiling is to be removed to enable the structure below the ceiling to be examined.

In insulated holds the limbers and hatches are to be lifted, and enough insulation is to be removed to admit of the framing and plating being examined.

3. All mast and bowsprit wedging is to be removed, except where the plating of masts or bowsprits is doubled in way of the wedging.

SPECIAL SURVEY No. 3.

1. The vessel is to be placed on blocks of sufficient height in a dry dock or on a slipway ; proper stages are to be made, and the holds and peaks are to be cleared for examination.

2. The steel work is to be exposed for examination and the rust removed, and, to enable this to be done, the close and spar ceiling, casings of pipes, and sufficient lining in way of sidelights are to be removed. If it is found, after removal of portions of the close ceiling, that the steel work is in good condition, free from rust, and coated, the removal of the whole may be dispensed with.

The cement chocks at the vessel's sides are to be examined, and portions removed, in order that the condition of the structure in way thereof may be ascertained.

Special attention is to be given to the examination of the ash shoots and the shell plating in way of the openings.

The surfaces are to be re-coated where considered necessary by the Surveyors.

3. The coal bunkers of steam vessels are to be cleared for examination, and the ceiling is to be removed. The bilges and limbers all fore and aft are to be cleaned out, so as to allow of these parts being properly examined.

4. In cases in which the inner surface or the bottom plating is coated with cement or asphalt, the removal of this coating may be dispensed with, provided it be carefully inspected, tested by beating or chipping, and found sound and adhering satisfactorily to the steel.

5. If the Surveyor deems it necessary, he may require holes to be drilled in any portion of the structure where signs of wastage are evident, in order to ascertain the thickness of the material.

6. Any parts of the structure which are found defective or materially less in substance than is required by the Rules are to be removed and replaced with proper materials, equal in substance and quality to that used in the original construction of the vessel.

7. The double bottom tanks are to be tested by a head of water to the light water-line, but in no case less than 2,45 m. above the inner bottom. Double bottom compartments, which are used for the carriage of oil fuel are to be tested by a head of water extending to the load water-line, or by a head sufficient to give the maximum pressure which can come upon them in practice, whichever is the greater.

Where peak tanks or other deep tanks for carrying water ballast are fitted, their watertightness is to be tested by a head of water not less than 2,45 m. above the crown of the tank.

All double bottom tanks are to be cleaned out, to admit of their being properly examined inside, special attention being given to the tanks under the boilers. All peak tanks, deep tanks and bunkers specially constructed for carrying oil fuel are to be examined internally and are to be tested by a head of water equal to 30 per cent. of the depth of the tank, or 2,45 m., whichever is the greater, provided the tanks are fitted with overflows or other means to prevent a greater pressure than indicated above. Where the tanks are not fitted with overflows or other similar devices, they must be tested by a head sufficient to give the maximum pressure which can be experienced in practice.

8. When a deck originally required to be 75 mm. thick is worn to 65 mm., 65 mm. to 50 mm., it is to be renewed. If, however, such deck is found on survey to be in good condition, the case will, upon application, receive the consideration of the Committee.

9. The chain cables are to be ranged for inspection, and the anchors and chains are to be examined and placed in good working condition. If any length of chain cable is found to be reduced in mean diameter at its most worn part to the extent indicated in **Table 56**, it is to be renewed.

10. The chain locker is to be examined internally.

11. The masts, spars, rigging, and general equipment of steam and sailing vessels must be examined and either found, or placed, in good and efficient condition. All mast and bowsprit wedging is to be removed, whether the plating of iron or steel masts or bowsprits is doubled or not.

In sailing vessels, the standing rigging is to be lifted, and the service and parcelling stripped off the nips, bends, and splices for examination ; if, however, the rigging has been recently fitted, particulars of the cases are to be submitted for the consideration of the Committee. The bobstay pins, the deadeyes and rigging screws to the whole of the standing rigging, also all bolts or pins and fittings are to be carefully examined.

12. The hatch covers and supports throughout are to be examined in position at the hatchways and, if defective, are to be renewed or made good.

The Surveyors should report on the efficiency of the tarpaulins, cleats, and battens, or other means of securing the hatches.

The ventilator coamings and covers are to be examined, and special care is to be taken to see that they are in an efficient condition.

13. The rudder, quadrant, tiller, steering gear, engine, and its connections and telemotor gear are to be examined.

Special attention is to be paid to the examination of all parts of rod and chain gears. All pins are to be examined and the chain is to be cleaned and examined for wear and tear. Any length of chain so worn that its mean diameter at its most worn part is reduced to the size in the Table, as given in the **Rules for Annual or Occasional Surveys**, is to be renewed.

The various parts of the auxiliary steering gear are to be examined in order to ascertain that the gear is in good and workable condition.

All replacements of chains are to be subjected, under the Society's supervision, to the proof tests as set forth for short link cables in **Section 14** of the **Rules for Quality and Testing of Materials**, and the certificates are to be produced. It is recommended that, in addition, the breaking test as required in **Section 14** mentioned above should also be applied to these chains, and that the tests be made at a proving establishment recognised by the Committee.

It is recommended that repaired chains be tested by the repairers and a certificate to that effect be produced.

It is recommended that a set of spares as required by **Section 33, clause 5** of the Rules be provided.

14. The windlass, pumps, sluice valves, watertight doors, and air and sounding pipes are to be carefully examined.

The Surveyor is to see that doubling plates are fitted under all sounding pipes.

15. Where holds are insulated for the purpose of carrying frozen or chilled meat, and the vessel in way of the insulation was examined by the Society's Surveyors at the time such insulation was fitted, the limbers and hatches are to be lifted, and enough insulation is to be removed in each of the chambers to admit of the framing and plating being exposed to satisfy the Surveyors of their general condition.

16. The freeboard recorded in the Register Book is to be verified.

17. The main and auxiliary engines and boilers and electrical equipment are to be examined and favourably reported on by the Society's Engineer Surveyors.

For Periodical Surveys of main and auxiliary engines and boilers and electrical equipment see pages 19–23.

Second and Subsequent Special Surveys No. 3.

1. All the requirements of Special Survey No. 3 are to be complied with.

2. In steamers, the inside of the bunkers, and the parts in way of the boilers, are to receive the Surveyors' particular attention, in view of the special liability of these parts to deterioration.

3. The shell plating is to be drilled at such parts as the Surveyors may consider necessary to satisfy themselves as to the thickness. The number of holes drilled on each side of the vessel is to be in no case less than three in each strake of plating not covered with cement, the holes being drilled about amidships, and in the vicinity of the peak bulkheads. All paint as well as rust is to be entirely removed before the plates are gauged, and the actual thicknesses at all parts drilled are to be stated on a sketch which is to accompany the Surveyors' report.

The plating in way of cement in the bottom need not be drilled, provided the cement be found to be adhering satisfactorily to the plating, and the Surveyors consider drilling at this part unnecessary.

4. Where holds are insulated for the purpose of carrying frozen or chilled meat, and the vessel in way of the insulation was examined by the Society's Surveyors at the time such insulation was fitted, the limbers and hatches are to be lifted, and additional insulation is to be removed in each of the chambers to admit of the framing and plating being exposed to satisfy the Surveyors of the general condition of the same, and to enable the shell plating to be drilled as required by the Rules.

5. In cases in which a Second Special Survey No. 3 is held on a vessel before she is 24 years old, the drilling of the outside plating referred to in clause 3 may be postponed until she reaches that age; but, until the requirements as to drilling have been fully complied with, the Survey in such cases will be described in the Register Book as Special Survey No. 3.

6. In cases in which the requirements of the Second Special Survey No. 3 are fully complied with before a vessel is 24 years old, the fact will be noted in the Register Book. Such notation, however, will not exempt a vessel from compliance with the requirements of the Survey as regards drilling when she is 24 years old, or at the first Special Survey held after that time, unless the drilling has been done at the previous Special Survey.

PERIODICAL SURVEYS OF MAIN AND AUXILIARY ENGINES AND BOILERS, ELECTRICAL EQUIPMENT AND EXHAUST STEAM TURBINES CONNECTED TO THE MAIN SHAFTING OF STEAM RECIPROCATING ENGINES.

ENGINES AND BOILERS OF STEAM VESSELS.

1. The machinery and boilers of all steam ships and the donkey boilers of sailing vessels are to be surveyed annually if practicable, and in addition are to be submitted to a Special Survey upon the occasions of the vessels undergoing the Special Periodical Surveys Nos. 1, 2 and 3, prescribed in the Rules, unless the machinery and boilers have been specially surveyed within a period of twelve months.

2. At these Special Surveys, and on other occasions if deemed necessary by the Surveyors, the propeller, stern-bush, sea connections, and their fastenings, are to be examined while the vessel is in dry dock.

3. The screw shaft is to be drawn at intervals of not more than three years in the cases of shafts fitted with continuous liners, and of shafts fitted with approved glands, or other approved appliances, at their after ends to permit of them being efficiently lubricated. In the cases of other screw shafts, they should be drawn at intervals of not more than two years. (On the application of owners, the Committee will be prepared to give consideration to the circumstances of any special case.)

4. (*a*) The cylinders, pistons, slide valves and crank shafts of reciprocating engines, and the blading, rotor shafts, and rotors as far as practicable, of turbine engines, together with thrust and intermediate shafts, pumps and condensers, are to be examined, and if necessary the condenser is to be tested. Where reduction gears are fitted, the shafts, shaft bearings, and teeth of the gears are to be examined.

(*b*) Where exhaust steam turbines are connected to the main shafting of steam reciprocating engines, through reduction gearing and hydraulic clutches or other mechanical means, or electric motors, the turbines, gearing and clutches or electric motors are to be examined as far as practicable. If found to be satisfactory, they need not be dismantled.

Where the power of the turbine is transmitted through a hollow gear wheel shaft attached to the main shafting by means of a coned coupling, the coned end of the internal driving shaft is to be exposed and the shaft to be examined as far as practicable.

These requirements will also apply to exhaust steam turbines, and other appliances driven by them, which are used in conjunction with the main engines.

5. The valves, cocks, pipes and strainers of the pumping arrangements are to be examined.

6. The boilers and superheaters are to be examined internally and externally, and if deemed necessary by the Surveyors, both boilers and superheaters are to be drilled or tested by hydraulic pressure; the safe working pressure is to be determined by their actual condition.

7. The principal boiler mountings are to be examined and the safety valves set to the safe working pressure.

8. All main steam pipes, also auxiliary steam pipes over 75 mm. bore, of iron, steel or solid drawn copper, supplying steam for essential services at sea, are to be stripped at each flange and tested to double the working pressure at the First Special Survey No. 2, and subsequently at each special survey.

Copper steam pipes as described above, but having a brazed longitudinal joint, are to be entirely stripped and tested to double the working pressure at each special survey.

9. The electrical equipment is to be examined, as detailed on page 23.

10. If satisfactory, these Surveys will be recorded in the Register Book thus:—"LMC6,35" *in red* or "B&MS6,35" *in red.*

11. "LMC" (LLOYD'S MACHINERY CERTIFICATE) denotes that the machinery and boilers are fitted in accordance with the Rules; and when followed by a date, indicates that they were found at that time to be in good condition. "MS" with a date denotes that the engines at that time were found upon inspection to be in good condition. "BS" with a date denotes that the boilers were found upon inspection at that time to be in good condition.

12. "B&MS" (BOILERS AND MACHINERY SURVEYED), with a date, denotes that the boilers and machinery, though not fitted strictly in accordance with the Rules, were found upon inspection at that time to be in good condition.

13. In the event of either the machinery or boilers appearing to be impaired to such an extent as to render it desirable that either or both be specially surveyed within the periods prescribed above, a Certificate for either machinery or boilers for a limited period will be granted according to the nature of the case.

BOILERS (INCLUDING PRESS BOILERS).

1. Water tube boilers are to be specially surveyed annually.

2. The boilers of all vessels are to be specially surveyed upon the occasion of the vessel undergoing the First Special Survey No. 1, also when six years old, and subsequently they are to be specially surveyed annually.

3. Press boilers and similar apparatus in floating whale-oil factories are to be specially surveyed when four and six years old, and subsequently they are to be specially surveyed annually.

4. At these surveys the boilers and superheaters are to be examined internally and externally, and if deemed necessary by the Surveyors, both boilers and superheaters are to be drilled or tested by hydraulic pressure ; the safe working pressure is to be determined by their actual condition.

5. The principal boiler mountings are to be examined, and the safety valves set to the safe working pressure.

6. If satisfactory these surveys will be recorded in the Register Book thus :—"BS6,35" *in red*, "DBS6,35" *in red*, and "Pr.BS6,35" *in red* respectively.

7. "BS" (BOILERS SURVEYED) or "DBS" (DONKEY BOILER SURVEYED), or "Pr.BS" (PRESS BOILERS SURVEYED) with a date, denotes that the boilers were found upon inspection at that time to be in good condition.

8. In the event of the boilers appearing to be impaired to such an extent as to render it desirable that they be specially surveyed within the periods prescribed above, a Certificate for a limited period will be granted according to the nature of the case.

PETROL, PARAFFIN, AND HEAVY OIL ENGINES AND THEIR AUXILIARIES.

1.—(*a*) In the cases of vessels propelled by petrol, paraffin, and heavy oil engines a complete survey of the machinery, as detailed in **clause 2**, is to be held upon the occasions of the vessels undergoing the Special Periodical Surveys Nos. 1, 2 and 3, prescribed in the Rules (*see* pages 11 to 18, unless the machinery has been thus surveyed within a period of twelve months.

(*b*) At each intervening period of two years a modified survey of the machinery, as detailed in **clause 3**, is to be held.

2. **Complete Periodical Survey.**—The complete periodical survey required in **clause 1, paragraph** (*a*), will consist of the following:—

(*a*) The main engines and the auxiliaries are to be examined throughout, viz., all cylinders, pistons, valves and valve gears, connecting rods and their top and bottom end brasses, crossheads, guides, pumps, clutches, reversing gears, crank, thrust and intermediate shafts, propeller, stern bush, sea connections and their fastenings.

(*b*) If compressed air is employed, the cylinders, pistons and valves of the compressors are to be examined. The air receivers are to be examined internally if possible, and, together with the air pressure pipes, are to be cleaned internally, if necessary, by means of steam, or otherwise. If the air receivers cannot be examined internally, they are to be tested by hydraulic pressure to twice the working pressure, attention being specially given in the case of welded receivers to the end and longitudinal joints.

(*c*) If electric ignition is employed the electric leads are to be examined and the system is to be tested. The magnetos are to be sent for inspection and overhaul to competent repairers.

(*d*) Where reduction gears are fitted, the shafts, shaft bearings and teeth of the gears are to be examined.

(*e*) Separate fuel storage tanks and daily service tanks, their fittings and connections are to be examined and, if deemed necessary by the Surveyor, the tanks are to be tested to the same pressure as specified for new tanks.

(*f*) The valves, cocks, pipes and strainers of the pumping arrangements are to be examined.

(*g*) The electrical equipment is to be examined, as detailed on page 23.

(*h*) The manœuvring of the engines is to be tested under working conditions.

3. **Modified Survey.**—The modified survey required in **clause 1, paragraph** (*b*), will consist of the following, viz.:—

(*a*) The parts of the engines which the engineers of the vessel open up for adjustment and overhaul should be examined and reported upon. The survey is to include, for each main engine, the examination of at least two pistons, with their cylinders, covers and valves, connecting rods and their top and bottom end brasses, two of the main crank shaft journals and bearings, and one of the intermediate shaft bearings. If these are all satisfactory, their condition may be taken as representing that of the other similar parts.

In the case of main engines having less than four cylinders, one of each of the parts aforementioned will be considered sufficient if found satisfactory.

Where petrol, paraffin, and heavy oil engines are fitted for driving auxiliary machinery, a similar course is to be adopted, but in this case one of each of the parts aforementioned of each engine will be sufficient, if found to be satisfactory.

(*b*) The valve gears are to be examined, as far as practicable. If found to be satisfactory, they need not be dismantled.

(*c*) The pumps, air compressors and clutches (where fitted), and reversing gears, are to be examined as far as practicable. If found to be satisfactory, they need not be dismantled.

(*d*) If compressed air is employed, the air receivers are to be examined internally if possible, and, together with the air pressure pipes, are to be cleaned internally, if necessary, by means of steam, or otherwise.

(*e*) If electric ignition is employed the electric leads are to be examined and the system is to be tested. The magnetos are to be sent for inspection and overhaul to competent repairers.

(*f*) Separate fuel storage tanks and daily service tanks, their fittings and connections, are to be examined externally, and, if deemed necessary by the Surveyor, the tanks are to be tested to the same pressure as specified for new tanks.

(*g*) If the examination reveals any defects, the Surveyor should recommend such further opening up as he may consider to be necessary.

4. **Screw Shaft.**—The screw shaft is to be drawn at intervals of not more than three years in the cases of shafts fitted with continuous liners, and of shafts fitted with approved glands, or other approved appliances, at their after ends to permit of them being efficiently lubricated. In the cases of other screw shafts, they should be drawn at intervals of not more than two years. (On the application of owners, the Committee will be prepared to give consideration to the circumstances of any special case.)

5. **Record of Survey.**—If the various parts mentioned in clauses 2 or 3 are found to be in a satisfactory condition, and the Surveyor finds that the machinery generally is in good order, he should recommend the vessel to have a fresh record of LMC, or LMC(M) as the case may be.

In the event of either the main or auxiliary machinery appearing to be impaired to such an extent as to render it desirable that either or both be specially surveyed within the periods prescribed above, a certificate for a limited period will be granted according to the nature of the case.

6. **Continuous Surveys.**—In the case of motorships fitted with heavy oil engines, if arrangements be made to open up the various parts of the machinery in regular rotation from time to time, so that the Society's Surveyors may examine the whole of the machinery every four years, the Rule requirements, both for modified and complete periodical surveys, will be complied with if such a procedure be adopted.

When the full requirements of the complete periodical survey have been complied with, a record of LMC (CS) (with date), (Lloyd's Machinery Certificate, Continuous Survey) will be assigned in the Register Book, the date being that of the completion of a cycle of the continuous survey.

ELECTRICAL EQUIPMENT.

1. On the occasions of vessels undergoing the special surveys Nos. 1, 2 and 3 prescribed in the Rules, the electrical equipment is to be examined.

2.—(*a*) Where the electrical equipment is for lighting purposes only, the installations are to be generally examined and tested under working conditions.

(*b*) The fittings on all main and sub-distribution switchboards and boxes are to be examined to ensure that the circuits are not overfused.

(*c*) The electric cables are to be examined as far as practicable without dismantling any fixtures or casings unless such dismantling is deemed to be necessary as the result of tests and observation.

(*d*) A test is to be made on generators, cables, heaters, fittings, etc., and the insulation resistance is to be not less than 100,000 ohms.

3.—(*a*) Where the electric generators are also used for supplying power for driving auxiliary machinery, steering gear, windlass or refrigerating machinery, the prime movers are to be opened out for examination in accordance with the Rules for the survey of Machinery set forth on pages 19 to 22 of the Rules.

(*b*) The generators and all motors driving essential auxiliary machinery are to be examined as far as practicable.

(*c*) All fittings on main and sub-distribution switchboards and boxes are to be examined to ensure that the circuits are not overfused.

(*d*) The electric cables are to be examined as far as practicable without dismantling any fixtures or casings unless such dismantling is deemed to be necessary as the result of tests and observation.

(*e*) A test is to be made on generators, motors, cables and other apparatus, heaters, fittings, etc., and the insulation resistance is to be not less than 100,000 ohms.

(*f*) All generators are to be run in turn or simultaneously ; all main switches and current breakers are to be operated, and all lamps, heaters, motors and other appliances run, though not necessarily under full load or simultaneously.

ANNUAL OR OCCASIONAL SURVEYS OF STEEL VESSELS.

1. At annual, or occasional surveys, vessels are to be examined generally as far as possible.

2. When a vessel is placed in dry dock, or on a slipway, the Society's Surveyors at the port are to avail themselves of the opportunity to examine the bottom of the vessel, and to examine the vessel throughout, as far as practicable, in order to satisfy themselves generally as to her condition.

3. Special attention should be given to the examination of the ash shoots and the shell plating in way of the openings, and to the condition of the hatchways, ventilators, and other openings in the deck.

4. Rod and chain steering gears are to be surveyed annually when special attention is to be paid to the examination of all parts of the gear. All pins are to be examined and the chain in the vicinity of the blocks is to be cleaned and examined for wear and tear. Any length of chain so

worn that its mean diameter at its most worn part is reduced to the size given in the following Table is to be renewed.

Original Diameter of Chain.	Mean Diameter requiring Renewal of Chain.	Original Diameter of Chain.	Mean Diameter requiring Renewal of Chain	Original Diameter of Chain.	Mean Diameter requiring Renewal of Chain.
m/m.	m/m.	m/m.	m/m.	m/m.	m/m.
9·5	8	20·5	18·5	31·5	28·5
11	9.5	22	19.5	33	30
12·5	11	23·5	21·5	35	32
14·5	12·5	25	22·5	36·5	33·5
16	14·5	27	23·5	38	35
17·5	16	28·5	25	39·5	36·5
19	16·5	30	27	41	37

The various parts of the auxiliary steering gear are to be examined in order to ascertain that the gear is in good and workable condition.

All replacements of chains are to be subjected, under the Society's supervision, to the proof tests as set forth for short link cables in **Section 14** of the **Rules for Quality and Testing of Materials,** and the certificates are to be produced. It is recommended that, in addition, the breaking test as required in **Section 14** mentioned above should also be applied to these chains, and that the tests be made at a proving establishment recognised by the Committee.

It is recommended that repaired chains be tested by the repairers and a certificate to that effect be produced.

It is recommended that a set of spares as required by **Section 33, clause 5** of the Rules be provided.

5. Whenever the engines or boilers are taken out, the bearers, with the floor plates, girders, rivets, and other parts of the structure, under them, are to be surveyed ; and whenever the bottom plating is to be cemented, a survey is to be held prior to the cement being laid. The masts and spars are to be subject to examination by the Surveyors when deemed necessary by them on other occasions besides Special Surveys.

6. The requirements for the survey of main and auxiliary engines and boilers and electrical equipment are set forth at page 19.

VESSELS NOT BUILT UNDER SURVEY.

1. **Hull.**—(*a*) Where a character is required for vessels not surveyed while under construction, application must be made to the Committee in writing. Drawings, with scantlings of the vessel marked thereon, as well as particulars of the testing of the steel used in the construction of the vessel, should be furnished.

A special examination is to be made, for which purpose the vessel is to be placed on high blocks in a dry dock or on ways; the hold is to be cleared and proper stages made; the rivets and plating of the bottom are to be thoroughly examined; the close ceiling in the hold is to be removed as required for Special Survey No. 3. The coal bunkers of steam vessels are to be cleared; the whole of the frames, stringers, floor plates, keelsons, engine and boiler bearers, beam knees, watertight bulkheads, rivets, and inner surface of the plating are to be exposed to view; all oxidation is to be removed from these parts and from the outside plating, rivets, keel, stem, sternpost, and rudder.

In cases where the inner surface of the bottom plating is coated with cement or asphalt, if the coating be carefully inspected, and tested by beating or chipping, and found sound and adhering satisfactorily to the steel, its removal may be dispensed with, provided that upon the removal of a portion, the plating, frames, and rivets under it be found in satisfactory condition.

(*b*) When the vessel is so prepared, the Surveyors are to ascertain the scantlings of the various parts, and verify the particulars given on the drawings furnished, drilling the shell plating and other parts where deemed necessary for this purpose. A few rivets are to be removed from various parts to ascertain their quality and the character of the countersinking and workmanship. A full report is to be made on a first entry report form in order that a character may be assigned to the vessel.

2. **Machinery.**—The engines are to be opened out for survey, at least to the extent required for the Special Surveys Nos. 1, 2 and 3; the screw shaft is to be drawn and examined, and the arrangements of sea cocks, bilge suctions, and valves, are to be made to conform to the requirements of the Rules.

The boilers are to be examined as required at Special Surveys, and the working pressure is to be determined from their actual scantlings in accordance with the Rules for the construction of boilers, and particulars should be furnished respecting the testing of the steel.

The electrical equipment is to be examined as required at Special Survey.

3. **Periodical Surveys.**—The periodical surveys are subsequently to be held as in the case of vessels built under survey.

71, Fenchurch Street, London, E.C.3.
8th April, 1937.

RULES FOR THE BUILDING OF STEEL VESSELS.

SUBMISSION OF PLANS.

Section 1. **Submission of Plans.**—Where ships are built for classification in the Register Book, plans of Midship Section, Longitudinal Section, Decks, Scheme of Riveting, Watertight Bulkheads, Deep Tanks, Oil Fuel Bunkers, Widely Spaced Pillars and Girders, Panting Arrangements, Strengthening of Bottom Forward, Propeller Brackets, Balanced Rudder, Bossed Framing, Cruiser Stern, Large Deckhouses, and any other plans which may be required, showing the details of the scantlings and arrangements proposed, are to be submitted through the local Surveyors for the approval of the Committee before the work is commenced.

TYPES OF VESSELS.

Section 2. 1. (*a*) The Rules and Tables give the scantlings for two basic types of vessels which are denoted—"Full Scantling Vessel" and "Complete Superstructure Vessel."

(*b*) The scantlings for the "Full Scantling Vessel" will entitle the vessel to the maximum draught that can be assigned for the dimensions of the ship.

(*c*) The scantlings for the "Complete Superstructure Vessel" will entitle the vessel to the maximum draught that can be assigned when the Depth for Freeboard Assignment is taken to the deck next below the complete superstructure deck.

(*d*) For vessels which are intermediate in character between the two basic types, the scantlings are to be determined by the interpolation between the requirements for full scantling vessels and for complete superstructure vessels in proportion to the draught desired.

(*e*) Vessels in which the draught desired is less than could be assigned as a "Complete Superstructure Vessel" may be specially considered by the Committee, and the scantlings adjusted according to the circumstances of the case and the draught desired, with the written consent of the owners.

In such cases, however, the standard of strength in relation to the draught must not be less than that represented by the two basic types referred to above.

(*f*) The class 100A will be assigned to vessels which comply with the requirements for a full scantling vessel.

(*g*) The class 100A "with freeboard" will be assigned to vessels which have a draught less than the maximum that can be assigned for the corresponding full scantling vessel.

(*h*) The Rules and Tables are framed for vessels of average ratios of breadth to depth, and of ratio of length to depth not greater than 13,5. Where the proportions are abnormal, special structural arrangements will be required to secure conformity with the standard of strength of the Rules.

DETERMINATION OF SCANTLING NUMERALS.

Section 3. 1. **Principal Dimensions.**—(*a*) **The Length** (**L**) is to be measured from the fore side of the stem to the after side of the sternpost on the summer load water line.

The length (**L**) of vessels having cruiser sterns is to be taken as 96 per cent. of the extreme length measured from the fore side of the stem to the aftermost part of the cruiser stern, but is not to be less than the length from the fore side of the stem to the after side of sternpost, or to the centre of the rudder stock where a sternpost is not fitted.

(*b*) **The Breadth** (**B**) is to be the greatest moulded breadth of the vessel.

(*c*) **The Depth** (**D**) is to be measured at the middle of length, from the top of keel to the top of beam at side of uppermost continuous deck. Where the draught desired corresponds to that which could be assigned as a Complete Superstructure vessel the depth (**D**) is to be measured to a point 2,30 m. above the deck from which the freeboard is assigned in vessels not exceeding 91,5 m. in length, and 2,45 m. above this deck in vessels greater than 91,5 m. in length. Where a vessel has more than one complete tier of superstructures, (**D**) is to be measured to the deck next above that from which the freeboard is assigned. For the purpose of these Rules, the deck to which the depth (**D**) is measured is to be regarded as the upper deck except where a vessel has more than one complete tier of superstructures.

(*d*) **A Framing Depth** (d) is to be measured vertically at the middle of length, from the top of ordinary floor or the top of double bottom at side to the top of the beams at side of the lowest deck or its equivalent.

(*e*) **Proportions.**—The depth (**D**) is to be used in determining the proportions, except in way of a strength deck other than the upper deck, where the depth is to be taken to the strength deck. In vessels in which the depth (**D**) has been modified as prescribed in paragraph (*c*) on account of the draught, the depth to be used in determining the proportions is to be the actual depth to the upper deck.

2. **Scantling numerals.**—The scantlings of the principal parts of the vessel are to be determined by

(1) The depth **D**

(2) The numerals $\mathbf{L} \times \mathbf{D}$ and $\mathbf{L} \times (\mathbf{B} + \mathbf{D})$ which are to be known as the "First Longitudinal Numeral" and the "Second Longitudinal Numeral" respectively.

(3) The proportions $\frac{\mathbf{L}}{\mathbf{D}}$

(4) The framing depth (d)

KEELS, STEMS, AND STERNFRAMES.

Section 4. 1. **Materials.**—(*a*) Where forgings are made from scrap material, either scrap iron or scrap steel may be used, but a mixture of scrap iron and scrap steel is not to be employed.

(*b*) Where forgings are made of Ingot Steel, the requirements of **Section 10** of the **Rules for the Testing of Materials** are to be complied with.

(*c*) Where castings are used, the requirements of **Section 9** of the **Rules for the Testing of Materials** are to be complied with.

2. **Bar Keels.**—The dimensions of bar keels are to be as given in **Table 1.** The scarphs connecting the lengths of bar keel to each other and of the keel to the stem and sternframe are to have a length of nine times the thickness of the keel, and the rivet holes required in the thin ends of the scarph connections are to be drilled in position.

3. **Flat Plate Keels.**—The breadth and thickness of flat plate keels are to be as given in **Tables 18** and **19,** and intercostal keelson plates, or centre through plates, are to be connected to the keel plate by angles of the dimensions given in **Table 10** for vessels with single bottoms and as given in **Table 6** for vessels with double bottoms. The keel plates are to overlap the stem and the sternframe.

4. **Stems.**—The dimensions of the stem are to be as given in **Table 1,** but may be gradually reduced from the load waterline to the stem head where the sectional area may be 75 per cent of the Table requirements.

5. **Sternframes in Single Screw Vessels.**—(*a*) The dimensions of the sternframe are to be as given in **Table 1,** but may be gradually reduced from the lower part of the rudder trunk to its head where the sectional area may be 50 per cent of that given in the Table.

The length of the sole piece of the sternframe in way of the aperture should be kept as short as possible.

In vessels having cruiser sterns the scantlings of the rudder post should be the same as required for the propeller post.

(*b*) Where the length exceeds 84 m. the foremost or propeller post is to extend above the arch of the sternframe and is to be efficiently connected to a deep transom plate which should be attached to the adjacent deck structure where practicable.

In the case of vessels whose length does not exceed 84 m. this requirement will apply if a cruiser stern is fitted.

(*c*) The sectional area of the sole piece of the sternframe is to be at least 20 per cent greater than that of the propeller post; this increase is to be provided in the thwartship dimension of the sole piece as far as possible.

(*d*) The thickness of the boss of the propeller post is to be at least 60 per cent of the thickness of the sternframe.

(*e*) The lower portion of the sternframe forming the keel connection is to extend forward from the fore side of the propeller post a distance of three times the amidship rule frame spacing, but need not extend forward of the after peak bulkhead provided an efficient attachment is obtained to the keel.

(*f*) In steamers above 107 m. in length the shell plating is to be connected to the sternframe below the boss with three rows of rivets.

6. **Sternframes in Twin Screw Vessels.**—(*a*) In the case of twin screw steamers which have no propeller aperture, sailing vessels and paddle steamers, the dimensions of the sternframe are to be as given in **Table 1,** but may be reduced from the lower part of the rudder trunk to its head, where the sectional area should be 75 per cent of that given in the Table.

(*b*) The lower portion of the sternframe forming the keel connection is to extend forward a distance of twice the amidship rule frame spacing from the fore side of the sternframe, but need not extend forward of the aft peak bulkhead provided an efficient attachment is obtained to the keel.

7. **Sternframes–General.**—(*a*) The lower portion of the sternframe is to be flattened out to give an efficient attachment to the flat plate keel when that form of construction is adopted.

(*b*) The sternpost is to extend to the top of the transom plate and is to be connected thereto by two double riveted angles where the breadth of the post exceeds 190 mm. The transom plate is to be 2,5 mm. thicker than the floors and is to have a depth of six times the thickness required for "sternframes with apertures."

(*c*) Where sternframes are made in more than one piece the scarph connections are to have a length of three times the fore and aft dimension of the sternframe and a breadth of 1,5 times the fore and aft dimension of the sternframe and are to be connected by four rows of rivets. The thickness of the tips of the scarphs is to be 13 per cent of the thwartship dimension of the post.

In vessels having cruiser sterns, the scarph of the rudder post in single screw ships should not be fitted in the vertical portion of the post above the top gudgeon.

(*d*) Gudgeons are to be forged on, or cast with the sternframe, and spaced to suit the rudder arms. The upper gudgeon should be as near as practicable to the rudder trunk and rudder coupling. The gudgeons are to have a depth of 70 per cent of the rudder head and a thickness of 50 per cent of the diameter of the pintles. The depth of the bottom gudgeon is to be sufficient to take a rudder pintle having a parallel length equal to 40 per cent of the diameter of the rudder head.

(*e*) In high powered vessels and in vessels with rudders of abnormal size or proportions, a plan of the proposed arrangement of the sternframe is to be submitted for the approval of the Committee.

RUDDERS.

Section 5. 1. **Materials.**—(*a*) Where forgings are made from scrap material, either scrap iron or scrap steel may be used, but a mixture of scrap iron and scrap steel is not to be employed.

(*b*) Where forgings are made of Ingot Steel, the requirements of **Section 10** of the **Rules for the Testing of Materials** are to be complied with.

(*c*) Where castings are used, the requirements of **Section 9** of the **Rules for the Testing of Materials** are to be complied with.

2. **Scantlings.**—(*a*) The diameters of rudder heads are to be determined from **Table 41**, on the basis of the speed of the vessel in conjunction with a numeral A × D,

where A is the total area in square metres of the rudder abaft the forward edge of the main piece, and

D is the distance, in metres, of the centre of gravity of area A abaft the centre line of the pintles,

(*b*) The scantlings of the rudder arms, coupling bolts, and other details, are to be in accordance with the requirements of **Tables 42, 43** and **44.**

3. **Single Plate Rudders.**—(*a*) The main piece of single plate rudders is to have a straight taper from below the top pintle to the heel, where it is to be of the size required by **Table 43.** The diameter at the top pintle is to be not less than that of the rudder head. The arms are to be fitted on alternate sides of the plate. Small fillets to arms forged or cast on the main piece are to have a radius of not less than 20 per cent of the distance between the arms. Large fillets are to have a radius at least equal to half the distance between the arms.

(*b*) Where arms are shrunk upon and keyed to the main piece, the diameter of the latter in way of each arm is to be increased 10 per cent to admit of an efficient keyway being cut. This increase in thickness is to be uniform all round the main piece, and is to extend above and below each arm for a distance equal to the increase in diameter, from which points it is to be gradually tapered over a similar distance into the normal diameter of the main piece. The thickness of the key is to be equal to 10 per cent of the diameter of the main piece, and its breadth equal to twice its thickness.

4. **Couplings.**—Where rudder heads are coupled, the dimensions of the bolts and the flanges of the palms are to be as required by **Table 42,** and the width of material outside the bolt holes is not to be less than two-thirds the diameter of the bolts. The bolts are to be "fitted," and the nuts are to be in proportion to the size of the bolts. Locking plates, split pins, or other efficient means are to be adopted to prevent the nuts from turning. The thickness of the tips of the palms of scarphed couplings is to be 13 per cent of the diameter of the head.

5. **Pintles.**—(*a*) The pintles are to be spaced as required by **Table 43,** and the top pintle should be as near as practicable to the rudder trunk. The pintles are to have the same depth as the gudgeons, and the parallel length of the bottom bearing pintle is to be at least 40 per cent of the diameter of the rudder head.

(*b*) The pintles of double plate rudders are to be spaced as required for single plate rudders, having an arm at each pintle.

6. **Rivets.**—(*a*) The rivets in the rudder arms are to be spaced 4,5 diameters apart, centre to centre in single plate rudders, and 5 diameters apart in the bows and stays of double plate rudders.

(*b*) Where the breadth of the arm exceeds 115 mm. reeled riveting is to be adopted, and where the breadth of the arms exceeds 175 mm., two complete rows of rivets spaced 4,5 diameters apart in each row are to be fitted. Where two complete rows are fitted the rivets are not to be directly opposite each other except at the outer ends of the arms.

(*c*) The rivet holes in rudder plates and arms are to be countersunk, and the rivets are to have full heads and points.

SIDE FRAMING.

Section 6. 1. **Scantlings.**—(*a*) The scantlings of the side frames at the standard frame spacing are set forth in **Tables 2, 2A, 3, 3A** and **4.**

The scantlings of the frames from one half length forward to a point 15 per cent. of the length of the vessel measured from the stem on the waterline are to be determined by a value of "d" measured at the half length forward.

(*b*) The scantlings given in **Tables 2** and **3** are applicable to flush deck full scantling vessels. In vessels having partial superstructures the scantlings of the frames are to be intermediate between those given in **Tables 2** and **2A** or **3** and **3A** in proportion to the total percentage length of the vessel covered by superstructures, the depth (**D**) being taken to the same deck in each case. The scantlings given in **Table 4** are applicable to complete superstructure vessels.

2. **Spacing.**—The spacing of the frames from centre to centre is to be in accordance with the size of the vessel, and as required by **Tables 2, 2A, 3, 3A** and **4.**

The frame spacing is not to exceed 685 mm. between the collision bulkhead and one-fifth of the vessel's length from forward and in the peaks the spacing is not to exceed 610 mm.

The frame spacing round the stern of the vessel at the knuckle may be the same as amidships, but is not in any case to be greater than 760 mm.

3. **Extent of Framing in 'Tween Decks.**—(*a*) **Full Scantling Vessels.** In way of detached superstructures the frames need only extend to the superstructure deck on alternate frames, except as follows :—

Poops.—Intermediate angle frames, which need not be attached at their lower ends, are to be fitted.

Long Bridges.—Intermediate angle frames may be dispensed with except for four frame spaces at each end of the bridge, where the frames as required in the upper 'tween decks are to be extended continuous to the bridge deck.

Short Bridges.—Intermediate angle frames which need not be attached at their lower ends are to be fitted. The arrangement of framing at each end of the bridge is to be the same as for long bridges.

Forecastles.—Intermediate angle frames are to be fitted and scarphed to the frames below or bracketed to the upper deck.

'Tween Decks below Upper Deck.—All the frames are to extend to the upper deck.

(*b*) **Complete Superstructure Vessels.**—The frames need only extend to the upper deck on alternate frames abaft one-fifth of the vessel's length from forward and forward of one-eighth of the vessel's length from aft. From these points forward and aft respectively, intermediate angle frames are to be fitted and scarphed to the frames below or bracketed to the second deck.

(*c*) The arrangements described in the above paragraphs apply only in vessels in which the Rule frame spacing is adopted and so long as such spacing does not exceed 760 mm.

In other cases the frames are to be fitted in the 'tween decks at every frame.

4. **Scantlings of Framings in 'Tween Decks.**—(*a*) **Full Scantling Vessels.** The frames in the detached superstructures where extended to the superstructure deck on alternate frames only are to have scantlings as required for bulb angle frames in peaks but may be 10 mm. less in depth.

In the upper 'tween decks all the frames are to be as required for bulb angle frames in peaks but may be 10 mm. less in depth.

In the second 'tween decks all the frames are to have the scantlings required for bulb angle frames in peaks.

(*b*) **Complete Superstructure Vessels.**—The frames which only extend to the upper deck on alternate frames and the frames in the second 'tween decks should have the scantlings required for bulb angle frames in peaks but may be 10 mm. less in depth.

(*c*) The breadth of the shell flange of the frame is to be suitable for the diameter of the rivets in the shell plating.

(*d*) Where the framing is not continuous the 'tween deck frames are to be efficiently scarphed to the frames below.

(*e*) Where intermediate angle frames are required to be fitted, the scantlings are to be as for angle frames in peaks except those in poops and short bridges in full scantling vessels and those in the upper 'tween decks of complete superstructure vessels abaft one-eighth of the

vessel's length from aft, which may be 10 mm. less in depth where the depth of the frame does not exceed 150 mm. and 20 mm. less in depth where the depth of the frame is over 150 mm.

(*f*) Where more than one tier of superstructures are fitted the scantlings of the framing in 'tween decks will be specially considered.

5. **Reversed Frames.**—(*a*) Where the framing consists of angle frame with reversed frame, the height to which the reversed frames are to extend is to be such as to make the strength of the framing in the 'tween decks equivalent to that specified in **clause 4** above.

(*b*) In vessels exceeding 76 m. in length, alternate reversed frames forward of the three-fifths length are to extend to the forecastle deck or to the upper deck in complete superstructure vessels in which a forecastle is not fitted.

(*c*) The overlap of frame upon reversed frame is to be not less than four times the diameter of the rivet.

6. **Cut Frames.**—Where frames are cut at watertight flats, they are to be attached to the plating of the deck by bracket plates of depth and breadth not less than three times the depth of the peak bulb angle frames; where the 'tween deck height exceeds 2,60 m., these brackets are to be increased.

Brackets of the same thickness as the frames to which they are attached are to be fitted at every frame, and are to have not less than two rivets more than required for beam knee bracket plates of the same dimensions. At peak tanks where the flare is excessive, the brackets are to be flanged on the face and, where necessary, increased in size.

7. **General.**—(*a*) Where the height between deck stringers at the side exceeds 2,60 m. at any part, additional transverse strengthening at such part is to be provided.

(*b*) Where hold frames are stopped at the lowest deck they are to be attached to the beams or bracketed to the deck stringer plate where beams are not fitted.

(*c*) The floors in the fore and aft peaks are to have the same thickness as the floors elsewhere.

(*d*) In after peaks the floors are to extend well above the stern tube but where the extension of the floor plates may not be practicable, deep cross-tie plates flanged on both upper and lower edges are to be fitted above the stern tube. The floors and cross-tie plates are to be connected to the frames with rivets spaced not more than 5 diameters apart, centre to centre. Arrangements are to be made to provide sufficient lateral rigidity to long cross-tie plates.

(*e*) In boiler rooms and permanent coal bunkers the thickness of the framing is to be increased 1,5 mm. beyond that given in the Tables.

(*f*) The rivet holes are to be punched from the faying surfaces of the frames and are not to be punched at the turn of the bilge, until the frames are bent to the required shape.

(*g*) The requirements for frames and reversed frames on the floors in single bottom vessels are given in **Section 8, clause 3.**

(*h*) Where wider frame spacing than that given in the Tables is proposed to be adopted, the requirements of **Section 14** are to be complied with.

(*i*) The requirements regarding the framing of cruiser sterns are given in **Section 24.**

(*j*) The framing in way of deep ballast tanks and oil fuel bunkers and in way of bossing for screw shafts will be specially considered and sketches showing the arrangements proposed are to be submitted for approval.

PANTING ARRANGEMENTS.

Section 7. 1. **Forward of the collision Bulkhead.**—(*a*) Tiers of beams on alternate frames are to be fitted within the peak below the lowest deck, these tiers being spaced not more than 1,85 m. apart. The scantlings of the beams are to be as required for upper decks having decks below, **Table 13.**

(*b*) Stringer plates of the dimensions required for lower deck stringer plates at ends of vessel are to be fitted to each tier of panting beams.

(*c*) If the stringer plates are attached to the outside plating, double angles or by single angles having flanges of sufficient breadth to take two complete rows of rivets should be fitted.

Frames at which there is not a beam are to be attached to the stringer plate by a knee, whose depth is to be one-half the breadth of the stringer plate.

(*d*) If the stringer plates are not attached to the shell plating the beams are to overlap the frames and the scantlings of the beams and of their end attachments are given in the Table below.

B		Beam.	Knee.	Rivets.	
Metres.		mm.	mm.	No.	mm.
6,70	Bulb Angles.	130 × 75 × 7	380 × 7,5	4	19
7,90		130 × 75 × 7,5	380 × 8	4	19
9,15		140 × 75 × 7,5	420 × 8,5	5	19
10,35		150 × 75 × 9	455 × 9	6	19
11,60	Channels.	150 × 75 × 75 × 9/12	510 × 9,5	6	19
12,80		150 × 75 × 75 × 11,5/12	560 × 10,5	6	22
14,00		180 × 80 × 80 × 10/13	610 × 11,5	6	22
15,25		200 × 85 × 85 11/14	685 × 12,5	7	22
16,45		220 × 90 × 90 12/15	760 × 13	8	22
17,70		240 × 95 × 95 × 14/15,5	840 × 13,5	9	22
18,90		260 × 95 × 95 × 15,5/16	915 × 14	10	22
20,10		280 × 100 × 100 × 16,5/16·5	990 × 14,5	11	22

The stringer plates are to be stiffened on their edges and attached to the intermediate frames by brackets having the same number of rivets as in the beam knees.

The thickness of the shell plating is to be 10 per cent greater than the thickness given in the Tables for the shell plating at the ends where the first longitudinal numeral does not exceed 225, and 25 per cent greater where the numeral is 930 or above; the increase at intermediate numerals to be in proportion.

2. **Abaft Collision Bulkhead.**—(*a*) The scantlings of the side frames below the lowest deck for a distance equal to at least 10 per cent of the vessels length measured from the Rule position of the collision bulkhead are to be as in **Table 5.**

(*b*) The rivets connecting the frames to the side plating are to be spaced 5,5 diameters apart, centre to centre.

(*c*) The gusset attachments and the corresponding rivets are to be increased 50 per cent above the requirements of **Table 8.** The number of rivets in the angles which attach the bracket plates to the margin plate are also to be 50 per cent greater than required by **Table 8.**

Where double angles are fitted connecting the bracket plates to the margin plate, the angles attaching the floors to the margin plate are also to be doubled. Where single angles double riveted are fitted, the angle attaching the floor plate to the margin plate is to have the same scantlings as the angle outside the margin, and is to be through-riveted thereto.

(*d*) Beam knees are to be in accordance with **Section 15, clause 3.**

(*e*) Side stringers, spaced 1,85 m. apart and extending throughout the region defined in **paragraph** (*a*) above, are to be fitted in line with the stringers in the peak and are to have the scantlings given in **Table 5.**

(*f*) Each side stringer is to be attached to the shell plating by a single angle having a single row of rivets in each flange.

(*g*) If the side stringers referred to above are not fitted, the thickness of the side shell plating is to be increased as required by **clause 1**(*d*).

3. **Deep 'Tween Decks.**—In vessels with deep 'tween decks additional intercostal side stringers are to be fitted at the fore end, supported by web frames if considered necessary.

4. **After Peak.**—(*a*) In the after peak tiers of beams and stringers are to be fitted similar to those required in the fore peak, except that the spacing of the stringers may be 2,45 m. Where the counter has excessive flare web frames and stringers or other equivalent strengthening is to be fitted where considered necessary by the Surveyors.

(*b*) Floors and cross-tie plates are to be fitted as required by **Section 6, clause 7** (*d*).

FLOOR PLATES IN VESSELS HAVING SINGLE BOTTOMS.

Section 8. 1. **Spacing.**—A floorplate is to be fitted and riveted to every frame and is to extend across the middle line, except where a vertical centre through plate is fitted, in which case the floors are to be efficiently connected to it on each side by double vertical angles having the same thickness as the centre plate.

2. **Scantlings.**—(*a*) The depth and thickness of the floor plates are to be in accordance with the requirements of **Table 9.** The thickness is to be increased above the midship thickness by 1 mm. in the engine space and by 2,5 mm. in the boiler space.

(*b*) The upper edges of the floor plates are not to be below the level of the upper edge at the centre line.

(*c*) Flanged bracket plates, of the same thickness as the floors, are to be fitted at the bilges, extending to a height above the base line equal to twice the depth of the floor at the centre line and having an overlap on the floor, inside the line of the frame, equal to the depth of the floor at the centre line.

(*d*) In vessels having considerable rise of floor the depth of the floor plates may be required to be increased.

(*e*) Towards the ends of the vessel the floor plates are to be gradually increased in depth in order that the sides may be efficiently connected when the brackets may be omitted.

(*f*) Floor plates forming part of bulkheads are not to be less than 910 mm. in depth, measured from the top of the keel, and the thickness is to be as required for the bottom strake of bulkhead plating.

3. **Frames and Reverse Frames on Floors.**—(*a*) Where the side frames extend only to the lower turn of bilge, the frames on the floor plates are to be of the same thickness as the floor and the breadths of the flanges sufficient for the diameter of the rivet used.

(*b*) Where the side frames are carried to the centre line of the ship, the overlap of the floor plate on the frame need only be sufficient to take one row of rivets.

(*c*) The reversed bars, fitted on the upper edges of the floors, are to have flanges of the size given for reversed frames in peaks and the thickness is to be the same as that of the floor. Where reversed bars are cut, a doubling angle forming a butt strap is to be fitted having at least three rivets on each side of the butt.

(*d*) Where floors are flanged on their upper edges as a substitute for fitting reversed bars, the thickness of the floors is to be increased 0,5 mm. and the breadth of the flange is to be equal to the breadth of the reversed bar omitted. Floors are not to be flanged in the engine space, under boiler bearers, or in way of the strengthening of bottom forward.

(*e*) Double reversed angles, extending from side to side, are to be fitted on every floor in the engine space and under boiler bearers.

(*f*) The thickness of all the reversed bars in the boiler space is to be increased by 2,5 mm.

4. **Watercourses.**—Watercourses are to be formed above the frames through all the floor plates on each side of the middle line, also at the lower turn of the bilges in vessels of full form, as well as through the vertical centre plate and intercostal keelsons, where such keelsons are fitted, in order that water may reach the pumps freely.

5. **Vessels Loading or Discharging Aground.**—In the case of small vessels intended to load or discharge while lying aground it is recommended that the bottoms be additionally strengthened in order to withstand the exceptional stresses to which they may be subjected.

6. **Strengthening of Bottom Forward.**—The requirements regarding the strengthening of the fore part of the bottom of steamers are contained in **Section 11.**

KEELSONS IN VESSELS HAVING SINGLE BOTTOMS.

Section 9. 1. **Scantlings.**—The Scantlings and arrangements of keelsons are to be as required by **Table 10.**

2. **Continuity.**—Where the keelsons are cut at the bulkheads the longitudinal strength is to be efficiently maintained.

Where keelsons, or other longitudinal members, are required for a certain portion of the length of a vessel, care is to be taken to avoid any abrupt discontinuity of strength at their terminations.

3. **Middle Line Keelsons.**—(*a*) All middle line keelsons are to extend as far forward and aft as practicable.

(*b*) Where flat plate keels are adopted intercostal or centre through plate keelsons are to be fitted.

(*c*) Intercostal keelsons are to be attached to the floors by single angles having the same thickness as the intercostal plates.

(*d*) Centre through plate keelsons are to have the thickness given in **Table 10,** and the floors are to be attached to them by double vertical bars of the same thickness as the keelson plate. Foundation plates of the same thickness as the centre plate and not less than 300 mm. in breadth are to be fitted above the floors, one on each side of the centre keelson, and are to be attached thereto by the continuous angles.

4. **Side Keelsons.**—(*a*) Where the moulded breadth of the vessel does not exceed 9,15 m., one side keelson is to be fitted on each side of the centre line, and where the breadth is above 9,15 m. and does not exceed 16,45 m., two side keelsons are to be fitted.

All side keelsons are to extend as far forward and aft as practicable.

(*b*) Double angles, of the dimensions given in **Table 10,** or single angles of equivalent sectional area, are to be fitted on the upper edge of the keelson.

(*c*) Side keelsons are to have intercostal plates attached to the shell plating by angles of the same thickness as the intercostal plates.

(*d*) In the engine space additional side keelsons are to be fitted and are to be attached to the shell.

(*e*) Where the intercostal plates are flanged on their lower edges as a substitute for fitting attachment angles to the outside plating their thickness is to be increased by 0,5 mm. Intercostals are not to be flanged in way of the strengthening of bottom forward.

5. **Increased Thickness in Boiler Room.**—The thickness of the centre and side keelson plates and bars not covered by cement is to be increased by 2,5 mm. in boiler rooms.

6. **Butt Connections.**—All angle and bulb angle bars of keelsons are to be in long lengths, and the butts are to be properly shifted and strapped with angles of the same thickness not less than 610 mm. in length. The butts of the keelson plates are to be properly shifted and are to be riveted as required by **Table 39.** The continuous keelson angles are to be attached to the reversed frames.

7. **Strengthening of Bottom Forward.**—The requirements regarding the strengthening of the fore part of the bottom of steamers are contained in **Section 11.**

DOUBLE BOTTOMS.

Section 10. 1. **Scantlings and Arrangements.**—The scantlings and attachments of the structure forming the double bottom are to be as required by **Tables 6, 7 and 8.**

2. **Centre Girder.**—(*a*) The centre girder is to have the depth and thickness given in **Table 6.**

(*b*) In vessels not exceeding 76 m. in length with machinery fitted amidships, and in vessels of 49 m. and under in length with machinery fitted aft, the angles attaching the centre girder to the keel plate and the inner bottom plating may be single except throughout the engine room and underneath the thrust seating and forward of the half length.

(*c*) In vessels exceeding 76 m. in length with machinery fitted amidships, and in vessels exceeding 49 m. in length with machinery fitted aft, these angles are to be double throughout.

(*d*) Single angles, double riveted, may, if desired, be fitted attaching the centre girder to the keel plate and to the inner bottom in vessels exceeding 76 m. in length with machinery fitted amidships, and in vessels exceeding 49 m. in length with machinery fitted aft, where the first longitudinal numeral does not exceed 1380.

The flanges of these angles are to be of sufficient width to take two complete rows of rivets, and the thicknesses are to be as given in **Table 6.**

In such cases double angles as required by **Table 6** are to be fitted attaching the centre girder to the inner bottom throughout the engine room, underneath the thrust seating, and from half length forward to the collision bulkhead.

Double angles, as required by **Table 6,** are also to be fitted attaching the centre girder to the keel plate from half length forward to the collision bulkhead.

3. **Side Girders.**—(*a*) One side girder is to be fitted on each side of the centre line when the rule breadth of the vessel exceeds 10,4 m., and does not exceed 19,5 m., and two side girders are to be fitted when the breadth does not exceed 23,8 m. In vessels not exceeding 10,4 m. in breadth the solid floors in the holds and boiler room are to be stiffened midway between the centre line and the margin plate, and a girder is to be fitted on each side for the full length of the engine room and at the forward end beyond the half length.

Side girders are to be extended as far forward and aft as practicable.

(*b*) Additional side girders are to be fitted in way of the engine seating and thrust block seating.

(*c*) All side girders under the engine seating and thrust block are to have double angles, or single angles with flanges broad enough to take double riveting, fitted on their upper edges.

4. **Floors.**—(*a*) Solid floors of the thickness given in **Table 6** are to be fitted on every frame in the engine space and on every frame forward of the three-fifths length. They are also to be fitted under the boiler bearers and under the bulkheads. Partial solid floors are to be fitted under the thrust seating.

(*b*) In vessels engaged in heavy trades, such as ore-carrying, it is recommended that solid floors be fitted on every frame.

(*c*) Except as provided above, solid floors may have a maximum spacing of 3 m.

(*d*) Bracket floors of the scantlings given in **Table 7** and **7A** may be fitted between the solid floors required by the previous paragraph.

(*e*) The brackets attaching the frames and reversed frames to the centre girder, and to the margin plate, are to be of the same thickness as the floors, and are to be flanged on their outer edges. The breadth of the bracket plates is not to be less than 0,75 of the depth of the centre girder.

(*f*) Solid floors under machinery space, thrust block and boiler bearers, are to be attached to the centre girder by double angles or single bars double riveted. Elsewhere floors may have single attachment bars.

(*g*) On bracket floors the vertical bars at the intercostal side girders are to be of the same scantlings as the reversed frames of these floors.

(*h*) The riveted attachments of the bulb angle frames and reversed frames to the brackets at the centre line and margin plate and to the vertical stiffeners on the intercostal girder are to comply with the requirements of **Table 7A.**

Where the frames and reversed frames are angles the number of rivets is to be as required by the Table for 130 mm. bulb angles.

(*i*) Where it is desired to reduce the span of bulb angle frames and reversed frames by fitting vertical struts, the scantlings of the struts and the attachments at their ends are to be as required by **Table 7A.**

(*j*) The thickness of the watertight floors in the double bottom is to be increased 2 mm. beyond that given in **Table 6,** but the thickness of these floors need not exceed that given in the Table for floors in boiler room. Where the depth of the centre girder exceeds 910 mm., stiffeners of the size given in **Table 7B** are to be fitted to all watertight floors and to be spaced not more than 760 mm. apart. The ends of the stiffeners are to be as close as possible to the boundary bars on the floors.

(*k*) The spacing of the rivets in the athwartship flange of the angle attaching the floors to the margin plate is to be the same as the spacing of the rivets in the fore and aft flange.

(*l*) Additional stiffening under the heels of widely spaced pillars is to be fitted as required by **Section 16, clause 3** (*d*) and (*e*).

5. **Double Reversed Frames in Machinery Space.**—Double reversed angles, or single bars with flanges broad enough to take two complete rows of rivets, are to be fitted on every floor in the engine space, on each floor below the boiler bearers and on each floor below the thrust seating. They are to extend in all cases from the middle line to beyond the girder outside the engine seating.

6. **Inner Bottom Plating.**—(*a*) The inner bottom plating is to be continuous longitudinally, but transverse plating may be fitted in way of the watertight bulkheads provided the margin plates and middle line strake be made continuous. The attachment of the transverse plates to the longitudinal inner bottom plating is to comply with the requirements of **Table 39** but is not to be less than double riveted.

(*b*) If ceiling is not fitted on the inner bottom under the hatchways, this plating is to be increased 2 mm. in thickness in way of the hatchways. The thickness of the middle line strake is in no case to be less than that of the inner bottom plating. Where the cargo is intended to be discharged by grabs or similar mechanical appliances it is recommended that the inner bottom plating be increased 5 mm. in thickness.

7. **Margin Plates.**—(*a*) The margin plate is to be of the depth and thickness required by **Tables 6** and **8.** The full depth of the margin plate is to be maintained from the collision bulkhead to the after three-fifths length, abaft which the depth may gradually be reduced to 85 per cent of the midship depth.

(*b*) Where gusset plates are fitted connecting the outside bracket knees to the inner bottom, the horizontal flanges

of the margin plates are to be of sufficient width to permit the landing edge of the inner bottom plating to be kept clear of the gusset plate attachment. The gusset plates are to have the same thickness as the floors.

8. **Tank Side Brackets and Angles.**—(*a*) The bracket plates connecting the side frames to the margin plate are to have the thickness given in **Table 8** and are to extend up the bilges to the height given in the same Table, this height being measured at the inner edge of the frame and maintained throughout. These brackets are to be flanged on the edge or stiffened by a reversed bar.

(*b*) Where the framing depth "d" exceeds 7,9 m. and the attachment outside the margin plate required by **Table 8** consists of double angles, the floor plate is also to be connected to the margin plate by double angles of the same width of flange. Where a single angle, double riveted, is fitted outside the margin plate, the angle fitted inside is to have the same dimensions as those of the external bar, and is to be riveted thereto.

(*c*) Where the bracket plate is attached to the margin plate by double vertical angles, the number and diameter of the rivets through the bracket plate and side framing are to be equivalent to the number and diameter of the rivets through the vertical bars, excluding the rivets in the gusset connection. Where the bracket plate is attached to the margin plate by a single angle, the number and diameter of the rivets through the bracket plate and side framing are to be equal to the number and diameter of the rivets in the vertical bar, with an addition equivalent to 50 per cent of the number of rivets in the gusset connection.

(*d*) Where the tank margin plate is approximately horizontal, the breadth of the horizontal arms of the brackets is not to be less than the rule depth of the margin plate, and is to be suitably increased to provide equivalent attachment where gussets are required by the Table.

9. **Increased Thicknesses in Machinery Space.**—(*a*) In the boiler space, including any donkey boiler recess, the floor plates and brackets, centre and side girders, inner bottom plating, margin plate and angle bars not covered by cement, and in the engine space the inner bottom plating, are to be increased in thickness as required by **Tables 6** and **7**. The thickness of the frame brackets outside the tank is to be increased 2,5 mm. in the boiler space.

(*b*) Where the machinery is fitted aft, the thicknesses given in **Table 6** for inner bottom plating in engine room are to be adopted throughout the engine room. In the boiler room the thicknesses are to be increased by the increments which would have been added if the machinery had been fitted amidships.

10. **Flanging.**—Floor plates are not to be flanged. Intercostals may be flanged, except under engines, thrust blocks, and pillars, and within the range of the additional strengthening of the fore part of the bottom, as required by **Section 11.** Where intercostals are flanged the thickness is to be increased by 10 per cent.

11. **Manholes and Covers.**—(*a*) Manholes with suitable steel covers are to be provided in the inner bottom plating in sufficient numbers to permit adequate ventilation, and to allow of easy access for the examination of all parts of the internal structure.

(*b*) Manholes and lightening holes are to be provided in the solid floors and intercostal side girders in such numbers and positions as will render all parts of the double bottom readily accessible. The edges of manholes should be smooth.

(*c*) Where the manhole covers are attached by bolts to the inner bottom plating, doubling plates or rims are to be fitted to receive the fastenings of the covers.

(*d*) Where ceiling is not fitted and the manhole covers or fittings to the double bottom of cargo holds project above the tank top, an angle coaming is to be fitted round each manhole with a hatch either of wood or steel.

12. **Free Passage of Air between Divisions.**—(*a*) Ample provision is to be made for the free passage of air and water from one division to another and to the air pipes, by fitting the liners short, or by having a sufficient number of holes as near to the inner bottom as possible.

(*b*) Air pipes are to be fitted in accordance with the requirements of **Section 34, clause 10.**

13. **Workmanship and Testing.**—All water-tight joints are to have the steel surfaces fitted as close as possible to each other, and are to be caulked efficiently. The double bottom is to be caulked and made water-tight, and each compartment on completion is to be tested with a head of water representing the maximum pressure which could be experienced in service.

14. **Vessels Loading or Discharging Aground.**—In the cases of small vessels intended to load or discharge while lying aground, it is recommended that the bottoms be additionally strengthened in order to withstand the exceptional stresses to which they may be subjected.

15. **Drainage.**—The pumping and draining arrangements are to be in accordance with the requirements of **Section 34, clauses 2** and **3.**

16. **Vessels Carrying Oil Fuel in Double Bottom.**—The modifications required in the scantlings and arrangements of double bottoms for the carriage of oil fuel are contained in **Section 20, Sub-Sections C** and **D.**

ADDITIONAL STRENGTHENING OF THE FORE PART OF THE BOTTOM.

Section 11. 1. **Double Frames.**—(*a*) The frames are to be doubled from the half length forward to the statutory position of the collision bulkhead, from margin plate to margin plate of double bottoms, or to the lower turn of bilges where a double bottom is not fitted.

(*b*) Instead of the double bars required by the previous paragraph, single bars may be fitted having flanges each of sufficient breadth to take two complete rows of rivets.

2. **Shell Plating.**—The thickness of the three strakes of shell plating next the keel is to be 10 per cent in excess of the midship thickness, and this is to be maintained from half length forward to the position of the collision bulkhead as defined by the Rules. In small vessels two strakes only need have this increased thickness if these cover entirely the flat of bottom.

3. **Side Girders.**—(*a*) In vessels having double bottoms the spacing of the intercostal girders forward of the half length is not to exceed 2,15 m., and additional intercostal girders attached to the shell and having a height of 0,5 the depth of the floor at that part are to be fitted extending as far forward as practicable.

(*b*) Where there is no double bottom in the fore part of a vessel, additional intercostal side keelsons are to be fitted from the half length to the position of the collision bulkhead specified in the Rules.

4. **Riveting.**—Forward of the half length, the rivets connecting the frames to the floors and plating in the bottom of vessels are to be spaced 5,5 diameters apart, centre to centre.

The seams of the shell plating are, in all cases, to be double riveted.

5. **Flanging.**—Floor plates or intercostals are not to be flanged within the range of the strengthening required by this Section.

SHELL PLATING.

Section 12. 1. **Thickness.**—(*a*) The thickness of the shell plating is given in **Tables 18** and **19** and the reduction towards the ends of the vessel is to be effected gradually.

(*b*) The strakes of shell plating next the keel are to have the thickness maintained forward as required by **Section 11, clause 2.**

(*c*) In single screw steamers the plates connected to the sternframe, and in twin screw steamers the plates connected to the spectacle frame and to the sternframe, are to be of the Table thickness required for the side plating amidships. Plates on the spectacle frame of twin screw steamers, and on the boss of single screw steamers, which require to be furnaced are to have the thickness required for propeller boss plates given in **Tables 18** and **19.** The shell plating is to be of increased thickness or doubled in the region of the hawse pipes.

(*d*) In way of long bridges the thickness of the upper deck sheerstrake and strake below may be as required for side plating.

(*e*) Where the breadth of the strakes of shell plating is excessive suitable compensation will be required.

2. **Shift of Butts.**—(*a*) The butts of shell plating are to be arranged to give as good a shift as possible and in adjoining strakes butts are not to be nearer each other than two frame spaces. Butts of alternate strakes, other than the strakes adjacent to flat plate keels, are not to be in the same frame space.

(*b*) The butts of the sheerstrakes are to be shifted at least two frame spaces from the butts of adjacent deck stringer plates.

3. **Fitting and Caulking of Butts and Edges.**—All outside edges of seams and butts are to be either planed or chipped fair and then carefully caulked.

Plates are to be sheared from the faying surface and if this be not done the burr caused by shearing is to be carefully removed.

4. **Openings in Topside Plating.**—(*a*) Where sidelight or other openings are cut in the sheerstrake, and the sectional area removed is greater than 20 per cent of the unpierced plate, compensation is to be provided by increasing the thickness of the plating.

(*b*) All openings in the shell plating for cargo doors, coal ports, and other purposes, are to have well-rounded corners, and arrangements are to be made to maintain the transverse and longitudinal strength in way of the openings.

5. **Liners.**—The spaces between plating and frames are to be closely fitted with liners of iron or steel which are to be in one piece and of the same breadth as the flange of the frame.

6. **Bulwark Plating.**—(*a*) The spacing between the stanchions which support the bulwarks is not to exceed 1,80 m. The stanchions nearest the ends of a bridge or long poop are not to be more than 1,50 m. from the bridge or poop bulkhead, and are to be formed of web plates. Where the bulwark plating and main rail are cut to form a gangway or cargo port, the bulwark stays at each end of the port are to be of increased strength.

(*b*) Care is to be exercised that continuity of strength is maintained at the break of erections; and gangways, doors, and other openings in the bulwark plating are to be kept well clear of these breaks. Where mooring pipes are fitted in bulwarks, the surrounding plating is to be doubled.

DECKS.

Section 13. 1. **Steel Decks.**—(*a*) Steel decks are to be fitted in accordance with the requirements of **Tables 20** to **26.**

(*b*) The scantlings of upper, second and third decks in association with beams on every frame are to be in accordance with the requirements of **Tables 20, 21** and **26.** The scantlings for upper decks given in **Tables 20** and **21** headed "Where One Deck is Fitted" apply to the upper decks of vessels having no decks below. The heading "Where Two Decks are Fitted" refers, as indicated by the sub-heading in the Tables, to the cases where the second deck is composed of stringers and tie plates or is a complete steel deck, and the heading "Where Three Decks are Fitted" refers to vessels which have three complete steel decks.

(*c*) The thicknesses given in the Tables are associated with a tumble-home of 300 mm. at the strength deck. If the tumble-home is greater or less than 300 mm. the thickness of the deck plating is to be increased or may be reduced to provide the same sectional area of material. The deck plating is not, however, to be less in thickness than required by **Tables 20** to **23.**

(*d*) The thicknesses given in the Tables are those required to be fitted abreast the deck openings, which are taken to be 40 per cent of the breadth of deck amidships in the upper and second decks, and 50 per cent in the third deck. If the width of the openings on the strength deck is greater or less than specified above, the thickness of the deck plating is to be increased or may be reduced to provide the same sectional area of material; and at lower decks, if the width of the openings is greater than specified, the thickness of the plating is to be increased. The deck plating is not, however, to be less in thickness than required by **Tables 20** to **23.**

(*e*) The thicknesses given in **Table 20** are applicable to flush deck full scantling vessels. In vessels having superstructures the thickness of the deck stringer and plating is to be increased as provided in the Table in proportion to the total percentage length of superstructures fitted.

(*f*) Between the deck openings on the upper and second decks the thickness of the deck plating may be reduced within the line of the hatchway side coamings to that given in the Tables. At decks below the second deck, the thickness of the plating within the line of the hatchway side coamings may be as given in **Table 26** for deck plating at ends.

(*g*) Within a partial superstructure exceeding 15 per cent of the vessel's length the thickness of the upper deck may be as required by the Tables for a second deck, and the thickness of the second deck may be as required for a third deck.

(*h*) Where there is indication of particular concentration of loading the Committee may require additional strengthening to be fitted to the decks.

(*i*) Where the beams at unsheathed steel decks required by the Rules are not fitted at every frame, the thickness of the plating is not to be less than 9 mm. where the spacing of the beams is 1,12 m., 10 mm. where the spacing of the beams is 1,37 m., and 11 mm. where the spacing of the beams is 1,52 m. At the sides of deck openings the thickness of the plating is not to be less than 11 mm. and this thickness is not to be reduced at the ends.

(*j*) Where the height of 'tween decks exceeds 2,60 m. the thickness of the strength deck is to be increased.

(*k*) All steel decks are to be caulked, unless sheathed with a properly caulked wood deck.

(*l*) Where the length of either the engine or boiler room opening exceeds 4,55 m. or the combined length exceeds 9,15 m., the deck abreast the openings is to be completely plated over. The plating is to extend two frame spaces beyond the opening, and is to be tapered thence to the stringer plate over a distance equal to the breadth of the plating required to be fitted.

2. **Stringer Plates.**—(*a*) Stringer plates of the dimensions given in **Tables 20** to **26** are to be fitted on the decks indicated. Deck stringer plates are to maintain the midship breadth and thickness for 0,5 the vessel's length amidships, and they are to be gradually reduced to the scantlings given for stringer plates at the ends of the vessel.

(*b*) Within a partial superstructure the thickness of the stringer plates may be modified in the same manner as permitted for deck plating.

(*c*) The stringer plates on all decks are to be connected to the shell plating with angle bars of the size required by **Tables 24** to **26.**

(*d*) The stringer plates of decks below the weather deck are to have an angle bar, 75 mm. by 75 mm., of the same thickness as the stringer plate fitted inside the frames. The thickness of this bar need not exceed 12,5 mm. The space between this angle bar and the shell plating is to be filled in with cement.

3. **Tie-plates.**—(*a*) Where steel decks are not laid, continuous tie-plates of the size given in the Tables are to be fitted on the beams upon each side of the hatchways, and tie-plates are to be riveted to the hatch end beams in order that the ends of the wood deck may be properly fastened.

(*b*) Where hatchways exceed normal breadth the deck is to be plated between the hatchway sides and the stringer plate.

(*c*) Where widely spaced pillars with girders are fitted, the scantlings of the tie-plates are to be increased.

4. **Minimum requirements for Steel Decks.**—(*a*) Unsheathed steel lower decks which are additional to those required by the Rules or for which credit is not taken in ascertaining the thickness of the upper deck are to have a thickness not less than 7,5 mm. where beams are fitted on every frame and not less than 8,5 mm. where beams are fitted on alternate frames. Where these decks are sheathed the thickness may be 7 mm. where beams are fitted on every frame and 7,5 mm. where beams are fitted on alternate frames.

(*b*) Unsheathed steel upper or bridge decks in vessels which do not require a steel deck by **Tables 20** and **21** are not to be less in thickness than 7 mm. for vessels 30,5 m. long and 7,5 mm. for vessels 61 m. in length where beams are fitted on every frame.

(*c*) The thickness of the stringer plate is to be 1 mm. greater than the thickness of the plating.

5. **Continuity of Strength.**—(*a*) Care is to be taken to preserve the continuity of strength at hatchways, at engine and boiler room openings and other openings and at deckhouses. For this purpose intercostal girders should be fitted below the uppermost deck and should be efficiently connected to the various coamings and casings by laps or brackets, or may be arranged to overlap in a satisfactory manner. The requirements at ends of superstructures are set forth in **Section 22, clause 4.**

(*b*) Doubling plates are to be fitted round the corners of all large openings in the strength deck plating. At the deck next below the strength deck doublings or long overlaps of the deck plating are to be fitted at the corners of the openings.

6. **Wood Decks.**—(*a*) The material employed is to be of good quality, properly seasoned, and free from sap, shakes and objectionable knots.

(*b*) The thickness of the deck is not to be less than 65 mm. of pine or 50 mm. of teak in vessels not exceeding 46 m. in length, and 75 mm. and 65 mm. for pine and teak respectively in vessels of greater length.

(*c*) Where gutter waterways are fitted at the weather deck, the angle bar forming the inner edge of the waterway is not to be less in thickness than 9 mm.

(*d*) Thwartships planks are to be laid at the end coamings of all hatchways and deckhouses.

(*e*) The width of kauri, oregon and pitch pine planks should not exceed 125 mm. and the oregon pine should be laid with the grain vertical.

(*f*) Where deck planks are 150 mm. in width or under, a single fastening will be accepted, but where the width exceeds 150 mm., two bolts are required for each plank at every beam.

The bolts are to be galvanised, nuts fitted on the under side, and properly sunk with oakum and white lead under their heads and carefully covered over with turned dowels bedded in white lead, marine glue, or other suitable composition. Pine decks not exceeding 75 mm. and teak decks not exceeding 65 mm. in thickness are to be fastened by bolts 12 mm. in diameter; planks of greater thickness are to be fastened by bolts 16 mm. in diameter.

(*g*) All decks are to be efficiently caulked and payed.

(*h*) The requirements for wood decks in sailing ships are given in **Section 35, clause 6.**

7. **Wood Sheathing.**—Where wood sheathing is laid over a steel deck, the thickness need not exceed 65 mm. of pine, or 50 mm. if of teak. The planking is to be efficiently secured to the deck plating between the beams, and the wood deck is to be efficiently caulked and payed.

8. **Deck Compositions.**—Where owners desire to use compositions as substitutes for wood sheathing on steel decks, these decks are to be caulked and made watertight prior to the substitute being applied.

If the chemical composition of the material is such that there is a possibility of corrosive action taking place between it and the steel, the steel deck is to be coated with an approved insulating material.

9. **Water Testing.**—Weather decks and gutterways on completion are to be water tested by hose.

INCREASED FRAME SPACING.

Section 14. 1. **Increased Frame Spacing.**—(*a*) Where a spacing of frames greater than that given in the Tables is desired, the scantlings of the various parts of the structure are to be increased as specified in this Section. Where this increase in spacing exceeds 230 mm., special consideration of the scantlings and arrangements will be given.

(*b*) The frame spacing is not to exceed 685 mm. between the collision bulkhead and one-fifth the vessel's length from forward, and in the peaks the spacing is not to exceed 610 mm.

2. **Double Bottom.**—(*a*) The thickness of the floor plates and tank side brackets is to be increased at the rate of 0,5 mm. for every 75 mm. increase in spacing. The floors may be stiffened by vertical bars between the intercostal side girders instead of being increased in thickness.

(*b*) The thickness of the inner bottom plating in the holds and the tank margin plate throughout are to be increased at the rate of 0,5 mm. for every 100 mm. increase in spacing, and the increase in the thickness of the inner bottom plating in the engine room is to be 0,5 mm. for every 150 mm. increase in spacing. The thickness of the middle line strake need not be increased but is not to be less than the remainder of the plating.

(*c*) Where bracket floors are fitted in the double bottom the scantlings of the frames and reversed frames are to be increased to give equivalent strength to that required by the Tables. The thickness of the bracket plates is to be the same as that of the floor plates as increased.

(*d*) The thicknesses of the material in the boiler room are to be increased by 0,5 the amount of the increase required in the holds.

3. **Side Framing.**—(*a*) The scantlings of the side framing in the holds and 'tween decks are to be increased so as to give equivalent strength and stiffness to the requirements of the Tables.

(*b*) All frames are to be extended to the superstructure deck where such is fitted.

4. **Shell Plating.**—The thickness of the bottom and side shell plating is to be increased at the rate of 0,5 mm. for every 50 mm. increase in spacing. The thickness of the sheer-strake and strake below need not be increased, but is to be at least equal to the increased thickness of side shell plating.

5. **Deck Beams.**—The scantlings of the beams and beam knees are to be increased to give equivalent strength to the requirements of the Tables.

6. **Pillars.**—The scantlings of closely spaced pillars and of the corresponding runners under the deck beams are to be increased to give equivalent strength to that required by the Tables.

7. **Deck Plating.**—(*a*) The thickness of the plating of the strength deck abreast the openings will not, in general, require to be increased with increase of frame spacing. Where, however, the thickness of the plating is less than that given below, it is to be increased 0,5 mm. for every 100 mm. increase in spacing until these thicknesses are reached.

Length of Vessel.	Increased Frame Spacing.	Thickness of Strength Deck Plating abreast Openings.
Metres.	Millimetres.	Millimetres.
76	760	9
91,5	760	9,5
91,5	910	10,5
122	910	12,5
152,5	910	15

(*b*) The thickness of the second and third decks is to be increased 0,5 mm. where a spacing increased to 910 mm. is adopted. This increase does not apply to the stringer plates.

(*c*) The thickness of the plating between deck openings need not be increased with increase of frame spacing.

(*d*) No increase will be required to the thickness of decks which are sheathed with wood.

8. **Middle Line Bulkhead.**—Where a middle line bulkhead is fitted the spacing of the stiffeners is not to exceed 1,52 m., and the scantlings of the stiffeners are to be in accordance with the spacing adopted.

9. **Riveting.**—(*a*) The diameter of the rivets and the number of rows of rivets are to be governed by the thickness of plating required at the Rule frame spacing.

(*b*) The spacing of the rivets is to be determined by **Table 38.**

(*c*) Where the Rule frame spacing is below 725 mm. and the increase in frame spacing exceeds 75 mm., the spacing of the rivets connecting the side frames to the shell plating is to be reduced by one-half of a diameter.

(*d*) The riveted attachment of the tank side brackets to the margin plate and to the main frames is to be increased in respect of the increased spacing adopted.

10. **General.**—In cases in which increased frame spacing is adopted, such local increases in scantlings are to be made as may be considered necessary.

BEAMS.

Section 15. 1. **Scantlings.**—(*a*) The scantlings of the beams at the various decks are set forth in **Tables 12** and **13.** Where the beam spacing is different from that shown in the Tables the scantlings of the beams are to be suitably modified.

(*b*) Where the beams between one-fifth of the vessel's length from forward and the collision bulkhead are spaced more closely than required by **Tables 12** and **13,** they may be reduced so as to give equivalent strength to the requirements of the Tables.

(*c*) The sizes of the half beams are to be determined by the breadth of the deck amidships in conjunction with the greatest length of unsupported beam abreast openings, and are to be obtained by interpolation from the sizes given in **Tables 12** and **13** for beams supported by one, two and three rows of pillars.

(*d*) The scantlings given in the Tables are applicable to a 'tween deck height of 2,60 m., and when this height is exceeded, the strength of the beams is to be increased in proportion to the increased height of 'tween decks.

(*e*) The beams of decks fitted exclusively for the accommodation of passengers may be of the size given for the beams of long bridge decks.

(*f*) Where cargoes such as chilled beef are suspended from the beams of decks, which may, at the same time, be loaded above, the strength of the beams of cargo decks is to be increased 33 per cent where one tier of quarters is carried, 66 per cent where two tiers, and 100 per cent where three tiers are carried.

In the case of weather deck beams, this increase is to be 50 per cent for one tier, and 100 per cent for two tiers but the scantlings of these beams need not exceed those of cargo beams which have been increased for the same purpose.

(*g*) Through beams with plating are to be fitted in the machinery space at the level of each deck wherever possible, but where this is impracticable, strong beams are to be fitted.

(*h*) Where the hatchway side coamings and end beams are reinforced to compensate for the omission of side and corner pillars, the scantlings of the hatchway end beams are to be as required by **Section 16.**

(*i*) Where the line of pillars at the side of hatchways is more than 450 mm. from the coamings, the overhanging half beams will require to be efficiently reinforced or the coamings will require to be made sufficiently strong as a girder to support the deck loads.

(*j*) Beams on which a steel deck is not fitted are to have equivalent strength to the requirements of **Tables 12** and **13.**

(*k*) The breadth of the deck flange of the beam is to be suitable for the diameter of the rivets in the deck plating.

(*l*) The requirements for beams in sailing ships are given in **Section 35, clause 4.**

2. **Spacing.**—(*a*) Beams are to be fitted at every frame :—

(1) At all watertight flats,
(2) At upper decks of all single deck vessels above 4,6 m. in depth,
(3) At unsheathed strength decks,
(4) At all decks where the frame spacing exceeds 760 mm.

(*b*) The beams of upper decks in way of poops, forecastles and bridges may be fitted at alternate frames, provided that for eight frame spaces within each end of the bridge, the beams are fitted at every frame.

(*c*) The beams of the various decks are to be placed over each other and, as far as practicable, are to be fitted to the frames which have reversed angles extended to the upper deck.

3. **Beam Knees.**—(*a*) Beams need not overlap the frames.

(*b*) The depths of beam knees are to be measured from the top of beam at side.

(*c*) The depths of beam knees are to be three times the depths of the beams given in the Tables, whether at every frame or at alternate frames.

(*d*) Where the size of the beams has been modified either for an alteration of frame spacing or of 'tween deck height or to suit special conditions of loading or support, the depth of the beam knees is to be three times the depth of the beam of bulb angle section required and the number of rivets in each arm of the knee is to be governed by the actual depth.

(*e*) The depths of the beam knees at the upper deck in vessels which have not a tier of beams below, and at the second deck in two-deck vessels where the hold frames are cut or scarphed at the second deck, are to be as required by paragraphs (*c*) and (*d*), or as given in the following Table, whichever is the greater.

The thickness of these knees is to be in accordance with **Tables 12** and **13**, or as given in the following Table for the depth of knee to be fitted, whichever is the greater.

The beam knees required by this paragraph are to be maintained throughout.

* Depth of Rule Angle, Bulb Angle or Channel Frame.	Beam Knees.		* Depth of Rule Frame formed of Channel and Reversed Angle.	Beam Knees.	
	Depth.	Minimum Thickness.		Depth.	Minimum Thickness.
mm.	mm.	mm.	mm.	mm.	mm.
130 or less	380	8	330	1120	11·5 Fl.
180	535	9·5	355	1200	11·5 Fl.
230	660	11	380	1270	12 Fl.
280	790	12			
330	910	10·5 Fl.			
380	1040	11 Fl.			

* After correction for frame spacing if required.
For intermediate depths of Rule Frames the beam knees are to be obtained by interpolation.

(*f*) Where the intermediate frames in 'tween decks are omitted beam knees of ordinary dimensions are to be fitted, and the number and spacing of rivets in each flange of the angle lugs connecting the knees to the side plating are to be the same as the number and spacing of those attaching them to the beam.

(*g*) The thickness of beam knees is to be in accordance with the requirements of **Tables 12** and **13**.

(*h*) Knees 910 mm. and above in depth are to be flanged on their inner edge.

Where the beam knees are flanged, the thickness may be reduced 20 per cent.

The breadth of the flange is not to be less than 50 mm. in brackets not exceeding 610 mm. in depth; 65 mm. in brackets above 610 mm. and not exceeding 910 mm. in depth; 75 mm. in brackets above 910 mm. and not exceeding 1120 mm. in depth; and 90 mm. in brackets exceeding 1120 mm. in depth.

(*i*) The number and size of the rivets in both arms of beam knees are to be as given in the following Table :—

Depth of Knee Measured from Deck.	Breadth of Knee Measured from End of Beam.	Number of Rivets.	Diameter of Rivets.
Millimetres.	Millimetres.		Millimetres.
350	250	4	16
430	300	4	19
530	380	5	19
610	430	5	22
710	530	6	22
810	610	7	22
910	690	8	22
1020	790	9	22
1120	890	10	22
1220	990	11	22
1320	1090	12	22

(*j*) Half beams fitted to alternate frames are to be connected to the coaming plates with double angles; half beams fitted to every frame may be connected to the coaming plates with single angles of not less thickness than the side coaming plates. There are to be two rivets in each flange of the angles connecting coamings to the half beams where the depth of the half beam is 200 mm., three in beams 220 mm. to 280 mm. in depth, and four rivets where the depth is 300 mm.

4. **Rows of Pillars.**—(*a*) The numbers of rows of pillars are determined in association with the scantlings of the beams and are to comply with the requirements of **Tables 14** and **15**.

(*b*) Beams at the ends of the vessel are to be equivalent in strength and stiffness to the beams amidships having regard to the span, and the scantlings may be obtained by interpolation between columns 1, 2, and 3 of **Tables 12** and **13**.

PILLARS AND GIRDERS.

Section 16. 1. **General.**—All beams are to be supported either by closely spaced pillars or by widely spaced pillars in association with longitudinal girders under the decks. Pillars in 'tween decks and holds are to be fitted in the same vertical line.

2. **Closely Spaced Pillars.**—(*a*) Closely spaced pillars, which may be of either iron or steel, are to be fitted at alternate frames in accordance with the requirements of **Table 14.**

(*b*) In way of poops, bridges, and forecastles, the scantlings of the pillars under each deck are to be as required by the Table for the deck next below.

(*c*) Where beams are fitted at every frame, pillars are to be attached at their heads to continuous fore and aft girders of double angles having the scantlings given in **Table 14.** The girders are to be attached to each beam and to the bulkheads by angle lugs.

(*d*) The heels of pillars at inner bottoms and at tops of deep ballast tanks are to be fitted and riveted to double angle bars or tee bars.

(*e*) The heads and heels of all pillars are to have a bearing fit.

(*f*) Pillars which support decks intended exclusively for the accommodation of passengers may be 3 mm. less in diameter than required by the Table where the diameter is 75 mm., 6 mm. less where the diameter is 100 mm., and 10 mm. less where the diameter is greater than 100 mm.

(*g*) Additional pillars are to be fitted to the beams below deckhouses, windlass, steam winches and capstans, and otherwise where considered necessary.

(*h*) Where double pillars are fitted for the purpose of securing shifting boards, their diameter is to be 0,75 the diameter required for single pillars.

(*i*) Where cargoes such as chilled meat are suspended from a deck which may at the same time be loaded above, the scantlings of the pillars are to be suitably increased.

(*j*) Where pillars are fitted on a shaft tunnel, the tunnel is to be additionally strengthened under the heels of the pillars if necessary.

(*k*) Pillars made of approved weldless rolled or drawn steel tubes may be of the diameter required by **Table 14** for hollow pillars with a reduction of 25 per cent in thickness. The steel of which these tubes are made is to have a tensile strength of not less than 55 kg. per square millimetre with an elongation of not less than 10 per cent in a length of 200 mm.

3. **Widely Spaced Pillars.**—(*a*) Where pillars are widely spaced, the scantlings are to comply with **Table 15,** and are to be determined on the basis of length of pillar in association with a numeral

$$S \times B \times H$$

where S is the fore and aft distance, in metres, from centre of span to centre of span;

B is that proportion of the breadth of deck, in metres, supported by the pillars;

H is the sum of the heights of the several superimposed 'tween decks measured, in metres, from top of beam to top of beam with an addition of 1,50 m. for the upper deck in Full Scantling vessels, and 1,20 m. for upper decks in Complete Superstructure vessels and for poop, bridge and forecastle decks.

In the case of a deck fitted exclusively for the accommodation of passengers, the height of 'tween decks may be taken as 1,20 m. For superimposed superstructures exclusively devoted to such accommodation this height may be taken as 0,90 m. in each case.

(*b*) The scantlings given in **Table 15** are arranged for pillars made of steel having a tensile strength of from 41 to 50 kg. per square millimetre. Where steel of 34 to 40 kg. per square millimetre tensile strength is used, the thickness is to be increased 20 per cent beyond the requirements of the Table.

(*c*) In the 'tween decks widely spaced solid pillars, having the scantlings given in **Table 15A,** may be fitted. These pillars are to have flat palms at their heads and heels and are to be attached by rivets of the number and diameter given in the Table.

(*d*) Effective arrangements are to be made to distribute the support of the pillars to the decks and to distribute the load on the pillars at the heels.

Where non-symmetrical types of girders are fitted longitudinal and transverse supporting brackets are to be fitted in way of the heads of the pillars.

Where considered necessary by the Committee, the attachment of the floors to the intercostals and of the floors and intercostals to the inner bottom plating below the heels of pillars, will be required to have additional riveting.

Where pillars are not stepped on the tank top at the intersection of a floor and an intercostal girder, intercostals and partial solid floors are to be fitted. Manholes are not to be cut in the floors and intercostals below the heels of pillars.

(*e*) Doubling plates are to be fitted on the inner bottom plating under the heels of widely spaced tubular pillars.

(*f*) Where cargoes such as chilled meat are suspended from a deck which may at the same time be loaded above, the scantlings of the pillars are to be suitably increased.

4. Deck Girders at Heads of Widely Spaced Pillars.—(*a*) Where widely spaced pillars are fitted, the beams between the pillars are to be supported by deck girders of the dimensions given in **Tables 16** and **17** and the scantlings of the girders are to be determined on the basis of the depth of girder in association with a numeral

$$S^2 \times B \times H$$

where S is the fore and aft spacing, in metres, of the pillars from centre to centre;

B is that proportion of the breadth of the deck in metres, supported by the girder;

H is the height of the 'tween decks next above the girder, measured in metres, from top of beam to top of beam where the pillars in the 'tween decks are placed immediately over those below.

For upper decks in Full Scantling vessels H may be taken as 1,50 m. For decks fitted exclusively for the accommodation of passengers and for upper decks in complete superstructure vessels and for poop, bridge and forecastle decks H may be taken as 1,20 m.

For superimposed superstructures exclusively devoted to passenger accommodation this height may be taken as 0,90 metres.

Where the pillars above a deck are not placed over those below, H is to be the sum of the heights of the several 'tween decks, in metres, above the girder, with an addition as specified above for the weather deck, or, is to be increased to correspond with the additional load supported.

(*b*) Plates, channels, bulb angles and angles forming component parts of girders, are to be fitted in long lengths and are to be efficiently strapped or lapped at the butts.

(*c*) Where girders are formed of channels, these are to be attached by two rivets either to the lower flanges of the beams, or to short angle lugs fitted to the beams.

Where girders have double lower angles, the intercostal plates are to be attached to the beams by angle lugs extending to the bottom of the girder and to the bottom of the beams alternately where beams are fitted at every frame, and to the bottom of the girder at every beam where beams are fitted at alternate frames.

Where girders have single bulb angles on the lower edge, plate brackets supporting the girder are to be fitted not more than three frame spaces apart when the beams are on every frame, or two frame spaces apart when the beams are fitted on alternate frames, and where double bulb angle girders are fitted these brackets may be four frame spaces apart. At deck girders abreast hatchways the supporting brackets are not to be more than two frame spaces apart. The beams between these plate brackets are to be attached to the girders by angle lugs, which extend alternately to the bottom of the beam and to the bottom of the girder.

(*d*) Girders are to be efficiently attached to the bulkheads by flanged brackets having a depth equal to twice the depth of the girder measured from the top of the beam and having the same thickness as the girder plate.

(*e*) Where cargoes such as chilled meat are suspended from a deck which may at the same time be loaded above, the scantlings of the girders are to be suitably increased.

5. Reinforced Hatchway Side Coamings and End Beams in 'Tween Decks.—(*a*) Where the hatchway side coamings of 'tween decks are designed to act as deck girders, the scantlings are to comply with **Table 17**, and the number to be used is given by

$$L^2 \times b \times H$$

where L is the length of hatchway in metres,

b is that proportion of the breadth of the deck, in metres, supported by the side coaming;

H is the height, in metres, of the 'tween decks next above the girder, measured as in **clause 4.**

(*b*) Where a hatchway side girder does not form part of a continuous fore and aft girder, it is to extend for a distance equal to two frame spaces beyond each end of the hatchway and is to be efficiently attached to the hatchway end beams by large gusset plates.

(*c*) Plate brackets are to be fitted not more than two frame spaces apart.

(*d*) Where the hatchway end beams which carry the hatchway side coamings are supported by pillars at the

centre line only, the scantlings are to comply with **Table 17**, and the numeral to be used is given by

$$0{,}75 \times L \times b \times B \times H$$

where L, b, and H have the same meaning as in paragraph (*a*);

B is half the breadth of the deck in metres at the hatchway end beam.

(*e*) The hatch end beam knees are to be increased in breadth and thickness beyond the ordinary requirements and are to be flanged on the edge.

(*f*) The frames to which the hatchway end beams are attached are to be reinforced if considered necessary.

(*g*) In cases where deep hatchway side coamings and end beams are fitted, as at weather decks, the arrangements will be specially considered.

6. **Riveting.**—(*a*) The number of rivets in the heads and heels of solid or hollow closely spaced pillars is to be regulated by their diameter in accordance with the following Table :—

Diameter of Pillar.	Number of Rivets.	Diameter of Rivets.
Millimetres.		Millimetres.
Not exceeding 90...	2	22
Above 90 and not exceeding 115...	3	22
„ 115 „ „ „ 150...	4	25
„ 150...	6	25

(*b*) Where pillars are fitted under watertight flats the rivet attachment is to be sufficient to withstand the load due to water pressure.

(*c*) The rivets in the seams of built tubular pillars are to be spaced not more than 5 diameters apart, centre to centre.

(*d*) The rivets in angles or channels forming pillars are to be spaced so as to close the work efficiently, and may be 7 diameters apart, centre to centre.

(*e*) The rivets in deck girders are to be spaced so as to close the work efficiently, and may be 7 diameters apart, centre to centre. The rivets in the intercostal angle are to be spaced not more than 5 diameters apart, centre to centre.

(*f*) The flanged brackets at the ends of the girders are to be double riveted to the girders and to the bulkheads.

7. **Machinery Spaces.**—(*a*) The beams in the machinery space are to be pillared as far as practicable.

(*b*) The requirements regarding the scantlings of bunker bulkheads which act as pillars are set forth in **Section 21.**

8. **Middle Line Bulkheads in lieu of Pillars.**—The requirements regarding the scantlings of non-watertight middle line bulkheads are set forth in **Section 21.**

WATERTIGHT BULKHEADS.

Section 17. 1. **Peak and Machinery Space Bulkheads.**—(*a*) A watertight collision bulkhead is to be fitted at a distance not less than 5 per cent of the vessel's length from the fore part of the stem at the waterline.

(*b*) An after peak bulkhead is to be fitted, and is to be arranged to enclose the shaft tubes in a watertight compartment.

(*c*) A bulkhead is to be fitted at each end of the machinery space.

2. **Additional Bulkheads.**—(*a*) Additional watertight bulkheads as follows are to be fitted at reasonable spacing :—

In vessels above 87 m. and not exceeding 102 m. in length, an additional watertight bulkhead is to be fitted about midway between the collision and boiler room bulkheads, making a total of five bulkheads.

In vessels above 102 m. and not exceeding 123,5 m. two additional watertight bulkheads are to be fitted, one in the forward hold and one in the after hold, making a total of six bulkheads.

In vessels above 123,5 m. and not exceeding 143,5 m. seven watertight bulkheads are to be fitted.

In vessels above 143,5 m. and not exceeding 164,5 m. eight watertight bulkheads are to be fitted.

In vessels above 164,5 m. and not exceeding 186 m. nine watertight bulkheads are to be fitted.

(*b*) Where in vessels above 67 m. and not exceeding 87 m. in length the machinery space is fitted aft, a watertight bulkhead is to be fitted about midway between the collision bulkhead and the bulkhead at the fore end of the engine and boiler space.

(*c*) In vessels in which the fitting of the number of bulkheads specified in the preceding paragraphs would interfere with the requirements of a special trade in which the vessel is to be employed, the Committee will be prepared to consider proposals from the owner to dispense with one or more bulkheads. In all such cases suitable structural compensation

for the omission of the bulkhead will be required, and a notation will be made in the Register Book describing the number and position of the bulkheads omitted.

(*d*) For bulkheads in sailing vessels, see **Section 35.**

3. **Height of Bulkheads.**—(*a*) The collision bulkhead is to extend in all cases to the upper deck.

(*b*) In Full Scantling vessels the bulkheads are to extend to the upper deck, except the after peak bulkhead, which, subject to the approval of the Committee, may extend to the first deck above the load waterline, provided this deck forms a watertight flat from the bulkhead to the stern.

(*c*) In vessels whose draught does not exceed that which could be assigned as a Complete Superstructure vessel the bulkheads need extend to the second deck only.

(*d*) In all vessels the machinery openings within the superstructure are to be efficiently trunked.

4. **Bulkhead Plating.**—(*a*) The plating is to be not less in thickness than required by **Table 31.**

(*b*) The lowest strake is to be at least 910 mm. in height, measured from the tank top, or from the keel in vessels having no double bottom, but where there is a double bottom on one side of the bulkhead only, the lowest strake is to extend at least 300 mm. above the double bottom. In all cases the lowest strake is to be at least 1 mm. thicker, and in the case of a stokehold or bunker bulkhead this strake is to be 2,5 mm. thicker than required by the Table. Where the stokehold or bunker bulkhead forms the boundary of oil fuel tank the increase to the lowest strake need only be 1 mm. At the end of a stokehold space the bottom plating of the bulkhead is to extend to a height not less than 610 mm. above the stokehold floor.

(*c*) Plates in the limbers are to be 2,5 mm. thicker than required by the Table.

(*d*) The bulkhead plating is to be doubled or increased in thickness in way of the stern tube opening.

5. **Bulkhead Stiffeners.**—(*a*) Vertical stiffeners are to be fitted of the size required by **Tables 27** and **28,** spaced 760 mm. apart, but this spacing may be increased up to a maximum of 910 mm. provided the strength be correspondingly increased.

The scantlings of stiffeners which are bracketed at one end and lugged at the other may be taken as a mean between those required by **Tables 27** and **28.**

(*b*) The spacing of stiffeners of collision bulkheads is not to exceed 610 mm. but the scantlings of stiffeners and thickness of plating are to be as required by **Tables 27, 28** and **31** for stiffeners spaced 760 mm. apart.

(*c*) The lower end of each stiffener is to be attached to the shell plating, or to the inner bottom plating, and the bracket, or its connecting angle, is to extend to the floor adjacent to the bulkhead.

At each deck level which forms the top of a system of stiffeners, plating is to be provided of a character which will ensure horizontal rigidity in the bulkhead, and the upper brackets on the stiffeners are to be connected to angles which extend over a beam space, when beams are fitted either at every frame or at alternate frames. In the latter case the vertical flanges of the angles are to be increased in depth by 20 mm. Other effective means may be adopted for securing the necessary structural rigidity in these parts.

The distance from the heel of the boundary bar to the extremities of the arms of the brackets is to be 2,5 times the depth of the stiffener and the thickness of the brackets and number of rivets in each arm is to be as required by **Table 30.**

(*d*) Where bulkhead stiffeners are cut in way of watertight doors in the lower part of a bulkhead, the opening is to be suitably framed, and a tapered web plate, stiffened on its edge, is to be fitted on each side of the door from the base of the bulkhead to well above the door opening.

Where stiffeners are not cut, but where the space between the stiffeners has to be increased on account of watertight doors in 'tween deck bulkheads, the stiffeners at the sides of the doorway are to be suitably increased in depth and strength so that the efficiency in this neighbourhood is at least equal to that of the unpierced bulkhead, without taking the stiffness of the door frame into consideration.

(*e*) Bulkheads are to be suitably strengthened at the ends of decks girders and where subjected to concentrated deck loads if necessary.

6. **Boundary Angles.**—The bulkheads are to be attached to the outside plating, decks, and inner bottom by single angles, not less than 2,5 mm. thicker than the tabular thickness of the bulkhead plating to which they are attached. These angles may be single riveted, except where situated more than 10,7 m. below the top of the bulkhead, when they are to be double riveted in both flanges. The flanges of the angles are to be not less than 75 mm. for

centre line only, the scantlings are to comply with **Table 17**, and the numeral to be used is given by

$$0{,}75 \times L \times b \times B \times H$$

where L, b, and H have the same meaning as in paragraph (*a*);

B is half the breadth of the deck in metres at the hatchway end beam.

(*e*) The hatch end beam knees are to be increased in breadth and thickness beyond the ordinary requirements and are to be flanged on the edge.

(*f*) The frames to which the hatchway end beams are attached are to be reinforced if considered necessary.

(*g*) In cases where deep hatchway side coamings and end beams are fitted, as at weather decks, the arrangements will be specially considered.

6. **Riveting.**—(*a*) The number of rivets in the heads and heels of solid or hollow closely spaced pillars is to be regulated by their diameter in accordance with the following Table :—

Diameter of Pillar.	Number of Rivets.	Diameter of Rivets.
Millimetres.		Millimetres.
Not exceeding 90...	2	22
Above 90 and not exceeding 115...	3	22
„ 115 „ „ „ 150...	4	25
„ 150...	6	25

(*b*) Where pillars are fitted under watertight flats the rivet attachment is to be sufficient to withstand the load due to water pressure.

(*c*) The rivets in the seams of built tubular pillars are to be spaced not more than 5 diameters apart, centre to centre.

(*d*) The rivets in angles or channels forming pillars are to be spaced so as to close the work efficiently, and may be 7 diameters apart, centre to centre.

(*e*) The rivets in deck girders are to be spaced so as to close the work efficiently, and may be 7 diameters apart, centre to centre. The rivets in the intercostal angle are to be spaced not more than 5 diameters apart, centre to centre.

(*f*) The flanged brackets at the ends of the girders are to be double riveted to the girders and to the bulkheads.

7. **Machinery Spaces.**—(*a*) The beams in the machinery space are to be pillared as far as practicable.

(*b*) The requirements regarding the scantlings of bunker bulkheads which act as pillars are set forth in **Section 21.**

8. **Middle Line Bulkheads in lieu of Pillars.**—The requirements regarding the scantlings of non-watertight middle line bulkheads are set forth in **Section 21.**

WATERTIGHT BULKHEADS.

Section 17. 1. **Peak and Machinery Space Bulkheads.**—(*a*) A watertight collision bulkhead is to be fitted at a distance not less than 5 per cent of the vessel's length from the fore part of the stem at the waterline.

(*b*) An after peak bulkhead is to be fitted, and is to be arranged to enclose the shaft tubes in a watertight compartment.

(*c*) A bulkhead is to be fitted at each end of the machinery space.

2. **Additional Bulkheads.**—(*a*) Additional watertight bulkheads as follows are to be fitted at reasonable spacing :—

In vessels above 87 m. and not exceeding 102 m. in length, an additional watertight bulkhead is to be fitted about midway between the collision and boiler room bulkheads, making a total of five bulkheads.

In vessels above 102 m. and not exceeding 123,5 m. two additional watertight bulkheads are to be fitted, one in the forward hold and one in the after hold, making a total of six bulkheads.

In vessels above 123,5 m. and not exceeding 143,5 m. seven watertight bulkheads are to be fitted.

In vessels above 143,5 m. and not exceeding 164,5 m. eight watertight bulkheads are to be fitted.

In vessels above 164,5 m. and not exceeding 186 m. nine watertight bulkheads are to be fitted.

(*b*) Where in vessels above 67 m. and not exceeding 87 m. in length the machinery space is fitted aft, a watertight bulkhead is to be fitted about midway between the collision bulkhead and the bulkhead at the fore end of the engine and boiler space.

(*c*) In vessels in which the fitting of the number of bulkheads specified in the preceding paragraphs would interfere with the requirements of a special trade in which the vessel is to be employed, the Committee will be prepared to consider proposals from the owner to dispense with one or more bulkheads. In all such cases suitable structural compensation

for the omission of the bulkhead will be required, and a notation will be made in the Register Book describing the number and position of the bulkheads omitted.

(*d*) For bulkheads in sailing vessels, see **Section 35.**

3. **Height of Bulkheads.**—(*a*) The collision bulkhead is to extend in all cases to the upper deck.

(*b*) In Full Scantling vessels the bulkheads are to extend to the upper deck, except the after peak bulkhead, which, subject to the approval of the Committee, may extend to the first deck above the load waterline, provided this deck forms a watertight flat from the bulkhead to the stern.

(*c*) In vessels whose draught does not exceed that which could be assigned as a Complete Superstructure vessel the bulkheads need extend to the second deck only.

(*d*) In all vessels the machinery openings within the superstructure are to be efficiently trunked.

4. **Bulkhead Plating.**—(*a*) The plating is to be not less in thickness than required by **Table 31.**

(*b*) The lowest strake is to be at least 910 mm. in height, measured from the tank top, or from the keel in vessels having no double bottom, but where there is a double bottom on one side of the bulkhead only, the lowest strake is to extend at least 300 mm. above the double bottom. In all cases the lowest strake is to be at least 1 mm. thicker, and in the case of a stokehold or bunker bulkhead this strake is to be 2,5 mm. thicker than required by the Table. Where the stokehold or bunker bulkhead forms the boundary of oil fuel tank the increase to the lowest strake need only be 1 mm. At the end of a stokehold space the bottom plating of the bulkhead is to extend to a height not less than 610 mm. above the stokehold floor.

(*c*) Plates in the limbers are to be 2,5 mm. thicker than required by the Table.

(*d*) The bulkhead plating is to be doubled or increased in thickness in way of the stern tube opening.

5. **Bulkhead Stiffeners.**—(*a*) Vertical stiffeners are to be fitted of the size required by **Tables 27** and **28,** spaced 760 mm. apart, but this spacing may be increased up to a maximum of 910 mm. provided the strength be correspondingly increased.

The scantlings of stiffeners which are bracketed at one end and lugged at the other may be taken as a mean between those required by **Tables 27** and **28.**

(*b*) The spacing of stiffeners of collision bulkheads is not to exceed 610 mm. but the scantlings of stiffeners and thickness of plating are to be as required by **Tables 27, 28** and **31** for stiffeners spaced 760 mm. apart.

(*c*) The lower end of each stiffener is to be attached to the shell plating, or to the inner bottom plating, and the bracket, or its connecting angle, is to extend to the floor adjacent to the bulkhead.

At each deck level which forms the top of a system of stiffeners, plating is to be provided of a character which will ensure horizontal rigidity in the bulkhead, and the upper brackets on the stiffeners are to be connected to angles which extend over a beam space, when beams are fitted either at every frame or at alternate frames. In the latter case the vertical flanges of the angles are to be increased in depth by 20 mm. Other effective means may be adopted for securing the necessary structural rigidity in these parts.

The distance from the heel of the boundary bar to the extremities of the arms of the brackets is to be 2,5 times the depth of the stiffener and the thickness of the brackets and number of rivets in each arm is to be as required by **Table 30.**

(*d*) Where bulkhead stiffeners are cut in way of watertight doors in the lower part of a bulkhead, the opening is to be suitably framed, and a tapered web plate, stiffened on its edge, is to be fitted on each side of the door from the base of the bulkhead to well above the door opening.

Where stiffeners are not cut, but where the space between the stiffeners has to be increased on account of watertight doors in 'tween deck bulkheads, the stiffeners at the sides of the doorway are to be suitably increased in depth and strength so that the efficiency in this neighbourhood is at least equal to that of the unpierced bulkhead, without taking the stiffness of the door frame into consideration.

(*e*) Bulkheads are to be suitably strengthened at the ends of decks girders and where subjected to concentrated deck loads if necessary.

6. **Boundary Angles.**—The bulkheads are to be attached to the outside plating, decks, and inner bottom by single angles, not less than 2,5 mm. thicker than the tabular thickness of the bulkhead plating to which they are attached. These angles may be single riveted, except where situated more than 10,7 m. below the top of the bulkhead, when they are to be double riveted in both flanges. The flanges of the angles are to be not less than 75 mm. for

19 mm. rivets, 90 mm. for 22 mm. rivets, and 100 mm. for 25 mm. rivets, where single riveted, and 125 mm. for 19 mm. and 22 mm. rivets, and 150 mm. for 25 mm. rivets where double riveted.

7. **Riveting.**—The rivets in the seams and butts of plating and in the boundary bars of bulkheads are to be spaced as required by **Table 38.** Where the distance below the bulkhead deck is more than 10,7 m., the vertical connections of plates are to be double riveted. The rivets connecting stiffeners to bulkhead plating are to be spaced not more than 7 diameters, centre to centre, and, in the case of stiffeners having no bracket attachment they are to be spaced 4 diameters apart for 15 per cent of their length from each end.

8. **Caulking and Watertightness.**—All watertight bulkheads are to be carefully caulked and their watertightness tested in accordance with **clause 13.**

In way of watertight flats the side framing is to be cut and bracketed to the deck, or watertightness is to be maintained by means of caulked angle chocks, or by cast steel or iron chocks efficiently secured and rust jointed.

9. **Watertight Recesses, Decks and Steps in Bulkheads.**—(*a*) Watertight recesses in bulkheads are to be framed and stiffened so as to provide equivalent strength and stiffness to watertight bulkheads.

(*b*) Watertight decks and steps in bulkheads are to have beams at every frame of the sizes given for stiffeners in **Table 28,** except where such beams are fitted in short lengths bracketed at each end, when they may be based on **Table 27.**

The horizontal plating is to be 1 mm. thicker than required for bulkheads under the same height from the top of the bulkhead or from the upper deck. In obtaining the necessary scantlings for beams and plating, account is to be taken of the spacing of the beams, and in no case are the sizes of these beams and thickness of plating to be less than required by **Sections 15** and **13** respectively of the Rules.

(*c*) The rivet connections of pillars are to be sufficient to withstand the load due to water pressure.

10. **Chain Lockers.**—Where chain lockers are fitted abaft the collision bulkhead, the bulkheads are to be caulked.

11. **Watertight Longitudinal Bulkheads.**—Watertight longitudinal bulkheads are to be equal in strength and stiffness to transverse bulkheads of the same depth.

12. **Watertight Doors.**—(*a*) Watertight doors are to be carefully and efficiently constructed and fitted, and strongly connected to the bulkhead, and are to be hose tested in place.

(*b*) Watertight doors are to be capable of being quickly closed from the bulkhead deck, and are to have an index at the operating position showing whether the door is open or closed. The lead of shafting is to be as direct as possible and the screw is to work in a gun-metal nut.

(*c*) Hinged watertight doors of approved pattern may be fitted in 'tween decks in approved positions. The hinges to these doors are to be fitted with gun-metal pins.

13. **Testing.**—(*a*) On completion, ordinary watertight bulkheads and deck flats are to be hose tested to the Surveyor's satisfaction.

(*b*) Fore and aft peak bulkheads which do not form the boundaries of ballast tanks are to be tested by the peaks being filled with water to a height of not less than the load waterline.

14. **Deep Tanks and Tunnels.**—The requirements for the construction of deep tanks and peak tanks are contained in **Section 19** and those for shaft tunnels in **Section 18.**

SHAFT TUNNELS.

Section 18. 1. **Tunnel.**—Where the engines are situated amidships, the shafting is to be enclosed in a watertight tunnel of dimensions which permit reasonable access for examination or repair of the shafting.

2. **Stiffeners.**—(*a*) Tunnel stiffeners are to be of the size required by **Table 32** and are to be spaced 910 mm. apart. The spacing of the stiffeners may be adjusted to suit the frame spacing provided an arrangement equivalent to the Rule requirements is obtained. The foot of each stiffener is to overlap and is to be attached in all cases to the tunnel base angle, which angle is to be 2,5 mm. thicker than the tunnel side plating. Angle stiffeners 150 mm. in depth and all bulb angle stiffeners are to be connected to the inner bottom plating by a lug.

(*b*) Where the shaft tunnel passes through a deep tank the construction is to comply with the requirements of **Section 19, clause 5.**

(*c*) Additional stiffening as may be necessary is to be provided where masts or hold pillars are stepped on the tunnel.

3. **Plating.**—The plating on the flat of tunnel sides is to be of the thickness required by **Table 31** for bulkhead plating with stiffeners spaced 910 mm. apart, and the curved plating may be of the thickness required for bulkhead

plating with stiffeners spaced 760 mm. apart. Where the spacing of the stiffeners exceeds 910 mm. the thickness of the plating is to be increased at the rate of 1 mm. for 150 mm. increase in spacing.

The top plating in way of the hatchways is to be not less than 2,5 mm. thicker than the remaining plates, or is to be covered with wood not less than 50 mm. thick secured by bands and angles so as not to have through fastenings in the tunnel plating.

4. **Tunnel Recess.**—The plating of the top of the tunnel recess is to comply with the requirements for bulkheads. The scantlings of the beams are to be determined on the basis of their unsupported span, in conjunction with the height of cargo which they may be called upon to support, but should not be less than required for watertight flats by **Section 17, clause 9.**

The rivet connections of the pillars supporting the beams are to be sufficient to withstand the load due to water pressure.

5. **Riveting.**—Riveting and caulking are to be as required for ordinary watertight bulkheads.

6. **Entrance Door.**—The tunnel is to be provided with a watertight door on the engine room bulkhead fitted in accordance with the requirements of **Section 17, clause 12.**

7. **Pipe Tunnel.**—If a pipe tunnel is led through the forward holds, the scantlings and arrangements are to be similar to those required for a shaft tunnel.

8. **Ventilators.**—Ventilators to tunnels are to have scantlings suitable for the pressure to which they may be subjected, and are to be made watertight.

9. **Testing.**—On completion, tunnels are to be hose tested to the Surveyor's satisfaction.

DEEP TANKS AND PEAK TANKS.

Section 19. 1. **Plating.**—The thickness of the plating of the boundary bulkheads is to be as required by **Table 31** for watertight bulkhead plating with stiffeners spaced 760 mm. apart. Where the height of the overflow pipe above the crown of the tank does not exceed 30 per cent of the depth of the tank, the thickness of each strake of the plating is to be governed by the depth below the top of the tank to the lower edge of strake. Where the height represented by 30 per cent is exceeded, the depth given above is to be increased by a distance equal to one-half the difference between the height to which the overflow pipe extends and the height represented by 30 per cent of the depth of the tank. In no case, however, is the thickness to be less than 7,5 mm.

2. **Stiffeners.**—(*a*) The spacing of the stiffeners on the boundary bulkheads is not to exceed 610 mm.

(*b*) The stiffeners are to be of the scantlings required by **Table 34,** and are to be determined on the basis of the length of stiffener in association with the head H, measured from the crown of the tank to the top of the stiffener, which is zero where the distance in metres from the crown of the tank to the top of the overflow pipe does not exceed 30 per cent of the depth of the tank. Where the height represented by 30 per cent is exceeded, H is to be taken as one-half of the difference between the actual height to which the overflow pipe extends and the height represented by 30 per cent of the depth of the tank. The stiffeners are to be bracketed at the deck and inner bottom. The sizes of the brackets and the number of rivets are to be as required for watertight bulkhead stiffeners of the same size.

3. **Deck.**—(*a*) The beams are to be fitted on every frame with scantlings in accordance with **Table 12,** but are to be not less in strength than required for the stiffeners of the boundary bulkheads. The beams are to be supported by an efficient intercostal girder on each side of the centre line, and special attention is to be paid to the riveting at the heads and heels of the quarter pillars.

(*b*) The deck plating forming the top of the tank is to be 1 mm. thicker than required for the boundary bulkheads under the same head, but is not to be less than 8,5 mm. with beams spaced 635 mm. apart, 10 mm. with beams spaced 760 mm. apart, and 11 mm. with beams spaced 910 mm. apart, but the thickness of the plating is not to be less than required by **Table 26.** If the deck plating is sheathed the thickness is to be as required for the plating of boundary bulkheads, or as required by the Tables for deck plating, whichever of these is the greater.

4. **Framing.**—The side frames in deep tanks are to be increased 10 mm. in depth beyond the normal frame.

5. **Tunnel.**—(*a*) Where the shaft tunnel passes through a deep tank, the spacing of the stiffeners is to be the same as the frame spacing, and the scantlings are to be equivalent to those required by **Table 34,** and as provided in **clause 2,** the length of stiffener being taken as the height from the base of the tunnel to the top of the flat side. The ends of the stiffeners are to be bracketed to the inner bottom.

(*b*) The thickness of the plating is to be equivalent to that required for the boundary bulkheads of the deep tank, having regard to the spacing of the stiffeners in each case.

6. **Washplates.**—Efficient washplates are to be fitted at the middle line in peak tanks ; they are also to be fitted in other water ballast tanks where the breadth exceeds 9,15 m.

7. **Boundary Angles.**—The boundary angles of the bulkheads are to be single riveted where the depth of the tank does not exceed 10,7 m. Where this depth is exceeded, the boundary angles are to be double riveted except at the deck, where they may be single riveted.

8. **Air Pipes.**—Air pipes are to be fitted at the opposite end to that at which the filling pipes are placed, or at the highest part of the tank. Their total sectional area is not to be less than the area of the filling pipes, and they are to be carried to above the upper deck, and their discharge ends are to be always open. Ample provision is to be made for the free passage of air to prevent the formation of air pockets.

9. **Ventilators.**—'Tween deck ventilators to deep tanks are to have scantlings suitable for the pressure to which they may be subjected, and are to be made watertight.

10. **Riveting.**—The riveting is to be as required for watertight work except that the rivets through the frames and shell plating are to be spaced 5,5 diameters apart, centre to centre, and the rivets attaching the stiffeners to the bulkhead plating are to be spaced 6 diameters apart, centre to centre.

11. **Testing.**—Tanks are to be tested by a head of water equal to 30 per cent of the depth of the tank, or 2,45 m. whichever is the greater, provided the tanks are fitted with overflows or other means to prevent a greater pressure than the test head. Where the tanks are not fitted with overflows or other similar devices, they are to be tested by a head sufficient to give the maximum pressure which can be experienced in practice, but in no case less than 2,45 m. In all cases the pressure to which the tanks will be subjected is to be indicated on the plans submitted for approval.

12. **Bulkheads forming part of Watertight Subdivision.**—Where the boundary bulkheads of the tank form part of the watertight subdivision of the vessel, the scantlings and arrangements of these bulkheads are not to be less than required by Section 17.

ARRANGEMENTS FOR CARRYING AND BURNING OF OIL USED AS FUEL.

A. GENERAL.

Section 20. 1. **Flash Point.**—(*a*) The following arrangements are applicable only to the cases where the oil fuel to be carried is such that its (close test) flash point, as determined by a standard type of flash point apparatus, does not fall below 65,5° Centigrade.

(*b*) For oil fuel with a lower flash point the arrangements are to be submitted for special consideration.

2. **Record in Register Book.**—In vessels arranged to use oil as fuel, and where the requirements of this Section have been complied with, the following records will be made in the Register Book :—"Fitted for oil fuel (date) F.P. above 150° F." in cases in which approval has been given for the use of oil with a flash point above 65,5° C. The notation "Fitted for low flash oil fuel" (date) will be made in cases where the arrangements have been approved for oil fuel with a lower flash point than 65,5° C.

B. OIL FUEL BUNKERS.

1. **Plating.**—The thickness of the plating of the boundary bulkheads is to be as required by **Table 31** for watertight bulkheads with stiffeners spaced 760 mm. apart. Where the height of the overflow pipes above the crown of the tank does not exceed 30 per cent of the depth of the tank, the thickness of each strake of the plating is to be governed by the depth below the top of the tank to the lower edge of strake. Where the height represented by 30 per cent is exceeded the depth given above is to be increased by a distance equal to one-half the difference between the height to which the overflow pipes extend and the height represented by 30 per cent of the depth of the tank. In no case, however, is the thickness to be less than 7,5 mm.

2. **Stiffeners.**—(*a*) The spacing of the stiffeners on the boundary bulkheads is not to exceed 610 mm.

(*b*) The vertical stiffeners are to be as required by **Table 34**, and are to be determined on the basis of span of stiffener between the horizontal supports in association with the head H, measured from the crown of the tank to the top of each span, where the distance, in metres, from the crown of the tank to the top of the overflow pipe does not exceed 30 per cent of the depth of the tank. Where this height is exceeded, H is to be increased by one-half the

difference between the actual height to which the overflow pipe extends, and the height represented by 30 per cent of the depth of the tank.

(*c*) The stiffeners are to be bracketed at the deck and inner bottom. The sizes of the brackets and the number of rivets are to be as required for watertight bulkhead stiffeners of the same scantlings.

(*d*) The vertical stiffeners on the boundary bulkheads and the side framing are to be supported by horizontal girders spaced about 2,45 m. apart. The scantlings of these girders are to be as required by **Table 33** and are to be determined by a numeral

$$S^2 \times D \times H$$

where S = overall length of girder, in metres.

i.e., S is the distance between the boundary bulkheads when the horizontal girders are all fitted within the compartment. Where the girders are not all fitted within the compartment S is to be increased in proportion to the increased span.

D = one-half the depth of the tank, in metres, where one horizontal girder is fitted.

= one-third the depth of the tank, in metres, where two horizontal girders are fitted.

= one-fourth the depth of the tank, in metres, where three horizontal girders are fitted.

H = the distance, in metres, from the crown of the tank to the horizontal girder where the height of the overflow pipe above the crown of the tank does not exceed 30 per cent of the depth of the tank. Where this height is exceeded, H is to be increased by a distance equal to one-half of the difference between the actual height to which the overflow pipe extends and the height represented by 30 per cent of the depth of the tank.

(*e*) The horizontal girders supporting the vertical stiffeners of the boundary bulkheads and the side framing are to be attached at their ends by flanged brackets. The toe of the bracket is not to be nearer the shell plating or the bulkhead plating than a distance equal to twice the breadth of the wider girder. The brackets are also to be double riveted in each arm.

Supporting bracket plates to the girders are to be fitted on every third stiffener or frame; the remaining stiffeners and frames are to be attached to the girders by angle lugs.

The girders are also to have supporting brackets at their intersection.

(*f*) In tanks which extend for the full breadth of the ship and which exceed 9,15 m. in length, the strength and stiffness of the horizontal girders are to be increased in proportion to the increased length of tank, and efficient transverse wash plate divisions may also require to be fitted if considered necessary.

(*g*) Where a steel deck abuts on an oil bunker bulkhead, the deck plating is to be attached to the bulkhead either by double angles, single riveted, or by tee bars.

3. **Tunnel.**—Where a tunnel passes through an oil fuel tank the scantlings are to be as required for a tunnel in a deep water ballast tank, but the angles attaching the tunnel plating to the inner bottom are to be double riveted.

4. **Middle Line Bulkhead and Washplates.**—(*a*) In tanks extending the full breadth of the ship a middle line bulkhead is to be fitted. Where this bulkhead is intact the construction is to be as required for the boundary bulkheads. If desired, this bulkhead may be perforated provided the total area of the openings does not exceed 10 per cent of the area of the bulkhead, in which case the horizontal girders may be dispensed with and vertical stiffeners of reduced size fitted.

(*b*) In tanks which extend for the full breadth of the ship, quarter washplates are to be fitted.

5. **Decks.**—(*a*) The beams are to be fitted on every frame with scantlings in accordance with **Table 12,** but are to be not less in strength than required for the stiffeners of the boundary bulkheads.

(*b*) The deck plating is to be as required for the crowns of deep water ballast tanks.

6. **Riveting.**—(*a*) The seams and butts of the bulkhead, deck and tunnel plating and the boundary bars, including the stringer angle, are to be double riveted. The rivets are to be spaced as required for vessels carrying oil in bulk.

(*b*) The seams of the shell plating are to be double riveted but ordinary watertight spacing may be adopted.

(*c*) The riveted connection of the horizontal girders to the bulkheads and shell plating may be by single angles, except at the ends of the girder, where they are to be double for a distance equivalent to twice the breadth of the girder. The rivets are to be spaced 4,5 diameters apart.

(*d*) In middle line bulkheads, whether perforated or not, the seams of the plating may be single riveted.

(*e*) The rivets attaching the frames to the shell plating are to be spaced 5,5 diameters apart, centre to centre. The rivets attaching the stiffeners to the bulkhead plating are to be spaced 6 diameters apart, centre to centre.

(*f*) The attachments of the frame brackets to the margin plate in way of the oil fuel bunker are to comply with the requirements of **Section 20, C 3.**

7. **Workmanship.**—(*a*) The workmanship throughout is to be of the highest character, and is to be submitted to the closest inspection.

(*b*) Plates are to be sheared from the faying surface.

(*c*) Particular attention is to be given to the removal of burrs, drillings and rimerings,

(*d*) Where holes for rivets are punched, the diameter of the punch is not to be more than 1,5 mm. greater than the diameter of the rivet.

Holes in liners are to be the same size as those in the plates.

Where there is difficulty in securing fairness of the holes, drilling in position should be resorted to.

(*e*) Where any unfairness exists in rivet holes, they are to be rimered and re-countersunk. Larger rivets are to be used for rimered holes.

(*f*) Surfaces of steel plates are to be fitted close to each other, and are to be caulked as far as practicable without the use of packing. Where packing is unavoidable, the material to be used should be non-soluble in oil.

(*g*) Where boundary bars consist of double angles, both flanges of each bar are to be caulked.

(*h*) Angle or T-bar connections, which are situated on a caulking side, are to be caulked.

(*i*) Attachments of fittings are to be made, as far as possible, without through fastenings. Where through bolts are fitted, they should be tapped, grommetted and set up.

8. **Ventilators.**—'Tween deck ventilators to oil fuel tanks are to have scantlings suitable to withstand the pressure to which they may be subjected and are to be made watertight. Gauze diaphragms are to be fitted over the mouths of the ventilators.

9. **Drainage.**—(*a*) Efficient means are to be provided by wells or gutterways, and sparring or lining, to prevent leakage from any of the oil fuel compartments from coming into contact with cargo, and to ensure that any such leakage shall have free drainage into the limbers or wells.

(*b*) Where there is a possibility of oil leakage from bunkers, storage tanks, settling tanks, service tanks, pumps, heaters, and other apparatus, suitable gutterways, cofferdams, drip trays, or drip screens, are to be arranged, and provision is to be made for draining these.

(*c*) Where cargo or coal is carried in a compartment adjacent to an oil fuel settling tank, which may be heated, the compartment side of the tank is to be insulated to prevent heating of the cargo or coal.

(*d*) Compartments for storing fresh water either for use in boilers or for drinking should be separated from oil compartments by cofferdams.

10. **Testing.**—Tanks are to be tested by a head of water equal to 30 per cent of the depth of the tank, or 2,45 m., whichever is the greater, provided the tanks are fitted with overflows or other means to prevent the occurrence of a greater pressure than the test head above. Where the tanks are not fitted with overflows or other similar devices, they are to be tested by a head sufficient to give the maximum pressure which can be experienced in practice, but in no case less than 2,45 m. In all cases the pressure to which the tanks will be subjected is to be indicated on the plans submitted for approval.

The attachment of all fittings to oil-tight surfaces should be completed before the tanks are tested. In any case, all oil-tight surfaces are to be examined prior to the completion of the vessel.

11. **Bulkheads forming part of Watertight Subdivision.**—Where the boundary bulkheads form part of the watertight subdivision of the vessel, the scantlings and arrangements of these bulkheads are not to be less than required by **Section 17.**

C. DOUBLE BOTTOMS.

1. **General.**—(*a*) Oil fuel may be carried in ordinary cellular double bottoms.

(*b*) Holes are not to be cut in the centre girder, except in way of the narrow tanks at the ends of the vessel. The centre girder need not be caulked or tested.

(*c*) The lengths of the compartments are to be submitted for approval.

(*d*) Compartments for storing fresh water, either for use in boilers or for drinking, should be separated from oil fuel compartments by cofferdams.

2. **Riveting.**—(*a*) Where ceiling is fitted the scantlings and riveting may be as required for water ballast tanks. Where ceiling is not fitted the inner bottom plating is to

have a minimum thickness of 10 mm. when the spacing of the frames is as required by the Rules and the seams and butts are to be at least double riveted.

(*b*) In the engine and boiler spaces the seams and butts of the inner bottom plating are to be at least double riveted.

(*c*) Ceiling, if fitted, is to be laid on transverse battens, leaving at least 50 mm. air space between the ceiling and the tank top.

3. **Gussets.**—(*a*) Where gussets are required by **Table 8** at every frame, a continuous plate is to be fitted attaching the tank side brackets to the inner bottom, and the number of rivets attaching this plate to the tank side brackets and to the inner bottom is to be 30 per cent in excess of the number required by **Table 8.**

Where gussets are required by the Table at alternate frames, a continuous plate is to be fitted as described above, and the number of rivets attaching this plate to the tank side brackets at each frame is to be 60 per cent of the number of rivets required by **Table 8** at alternate frames.

The rivets attaching the continuous plate to the inner bottom may be spaced 5 diameters apart, but the number in each frame space is not to be less than the number connecting the plate to the tank side bracket.

Where gussets are required by the Table at every third frame, gusset plates are to be fitted at every second frame and the number of rivets in each arm is to be as specified in **Table 8** for every third frame.

Where gussets are not required by the Table, the number of rivets in the vertical bar attaching the tank side brackets to the margin plate is to be increased 40 per cent.

(*b*) The holes in the margin plates to take the gusset plate rivets are to be countersunk, and countersunk headed rivets are to be used.

(*c*) The above requirements are also to be complied with where oil fuel is carried in bunkers or deep tanks above an inner bottom compartment.

4. **Testing.**—All double bottom compartments intended for carrying oil fuel are to be tested by a head of water representing the maximum pressure which could be experienced in service.

The attachment of all fittings to oil tight surfaces should be completed before the tanks are tested. In any case, all oil tight surfaces are to be examined prior to the completion of the vessel.

5. **Workmanship.**—The workmanship is to be as required for Oil Fuel Bunkers.

D. FITTINGS AND CONTROL.

1. **General.**—In addition to the special requirements detailed below, the requirements of **Section 34** are to be complied with as far as they are applicable in respect to the drainage of tanks, oil bilges and cofferdams, and in respect to the height of air pipes above the freeboard or superstructure decks.

2. **Service, Settling and other Tanks.**—Where such tanks do not form part of the structure of the vessel, the scantlings and arrangements are to be submitted for approval.

In general, the thickness of the plating of these tanks is to be not less than 6 mm. but in the case of very small tanks, the thickness of the plating may be not less than 3 mm. Adequate stiffening of the plating is to be provided where necessary.

3. **Air, Overflow, and Sounding Pipes.**—(*a*) Each oil fuel compartment is to be fitted with one or more air pipes, the discharge ends of which are to be led to the open air in a situation where no danger will be incurred from the issuing oil vapour when the compartment is being filled, and each is to be furnished with a wire gauze diaphragm which can readily be removed for cleaning or renewal.

Where no overflow pipes are fitted, the sectional area of the air pipes to each compartment is to be not less than that of its filling pipe.

(*b*) Where overflow pipes are fitted to any oil fuel compartments, they are to have not less sectional area than the filling pipes, and are to be so arranged that no oil or vapour issuing from them will be a source of danger.

For this purpose overflow pipes to oil fuel tanks which are situated above the level of the engine room floor plates are to discharge direct to suitably constructed oil wells or overflow tanks of suitable capacity, situated in the lower part of the machinery space, or alternatively an approved alarm device should be fitted to the overflow pipes.

Where the overflow pipes are led to tanks which may be pumped up with water ballast, non-return valves are to be provided on the overflow lines to prevent water ballast entering the oil fuel tanks, or, alternatively, a suitable change over device is to be provided.

(*c*) Each oil fuel compartment is to be provided with a suitable means for ascertaining the oil level therein, either by sounding pipes or by approved indicating apparatus. If sounding pipes are fitted, they are to be led to the weather deck, or to an accessible position on a deck above the load water line; short sounding pipes may be approved

in the shaft tunnels or machinery spaces, provided they are fitted to close automatically or with lock-up screw caps of approved type. Doubling plates are to be fitted under all sounding pipes.

(*d*) Round gauge glasses are not to be fitted either to the oil storage, settling, or service tanks, but suitably protected gauges of approved design, having flat glasses of substantial thickness, and self-closing cocks or valves, may be allowed on settling and service tanks.

(*e*) Where sounding pipes or gauge glasses of approved type are not fitted, the level indicating apparatus is to be of approved type and is to be tested after fitting on board, to the satisfaction of the Surveyors.

4. **Boiler Insulation.**—(*a*) The boilers are to be suitably lagged. The clearance spaces between the boilers and tops of the double bottom tanks, and between the boilers and the sides of the storage tanks or bunkers in which oil fuel is carried, are to be adequate for the free circulation of air necessary to keep the temperature of the stored oil well below the flash point.

(*b*) Where water tube boilers are installed, it is recommended that there should be a space of at least 760 mm. between the tank top and the underside of the pans forming the bottom of the combustion spaces.

(*c*) Funnel dampers, if fitted, must be provided with a suitable device whereby they may be securely locked in the fully open position. Funnel dampers must not be fitted on ships equipped for burning oil fuel only.

(*d*) Smoke box doors are to be shielded and well fitting, and the uptake joints made airtight.

5. **Oil Fuel Pumps and Oil Burning Appliances.**—(*a*) In every ship where steam for main or auxiliary machinery required for essential services at sea is to be produced by burning oil fuel, there are to be no fewer than two units (a unit comprising pressure pump, suction and discharge filters, and heater). The pressure pumps for the oil fuel burning system are to be entirely separate from the feed, bilge and ballast pumps and connections.

(*b*) All pumps used in connection with oil fuel are to be provided with effective escape valves, which are to be in close circuit, i.e., discharging to the suction side of the pumps.

(*c*) If the oil fuel is sprayed by steam, meant are to be provided to carry or make up the fresh water used for this purpose.

6. **Oil Pipes and Fittings.**—(*a*) The oil pressure pipes conveying heated oil are to be of solid drawn steel, and placed in sight above the platforms in well-lighted parts of the stokehold or engine-room. The coupling flanges are to be machined so that they are practically metal to metal, any jointing material used being the very thinnest possible, and impervious to oil heated to 120° C. The scantlings of the flanges are to be made suitable for at least 14 kg. per cm^2. working pressure, or the pressure to which the relief valves are loaded, whichever is the greater.

The pipes, heaters, and their fittings are to be tested after jointing to be at least 28 kg. per cm^2., or to double the working pressure, whichever is the greater.

The working pressure of the oil fuel pressure pipes is to be determined from the formula contained in **Section 6, clause 15,** of the **Rules for Heavy Oil Engines.**

(*b*) Other oil fuel pipes, and all bilge or water pipes passing through oil storage tanks are to be made of iron or steel. The coupling flanges are to be machined and the jointing material used is to be impervious to oil. The scantlings of the flanges are to be made suitable for not less than 7 kg. per cm^2. working pressure, and, after jointing, the oil fuel pipes within the engine and boiler spaces are to be tested to 2 kg. per cm^2., or twice the working pressure, whichever is the greater. All such pipes within the engine and boiler spaces are to be led sufficiently high above the inner bottom to facilitate inspection and repairs.

7. **Valves and Cocks.**—(*a*) All oil fuel suction pipes are to be fitted with valves or cocks at the bulkheads where they enter the machinery space.

(*b*) In the case of all oil fuel storage, settling and daily service tanks, other than double bottom tanks, the suction valves or cocks are to be secured to the tanks, and so geared that they may be shut off from positions which will always be accessible in the event of fire taking place in the compartment in which they are situated. In the case of peak tanks, these valves or cocks are to be fitted on the tank side of the peak bulkheads.

(*c*) All valves or cocks in the machinery space connected with oil fuel installations are to be capable of being controlled from above the engine and boiler room platforms.

(*d*) Where the filling pipes to settling and service tanks are not connected to the tanks near the top, they are to be provided with valves or cocks, controlled as in the case of the suction valves or cocks on these tanks, or else with non-return valves, secured to the tanks.

(*e*) Valves or cocks are to be interposed between the pumps and the suction pipes in order that the latter may be shut off when the pumps are opened out for overhauling.

(*f*) Test cocks or open drains for removing the water from oil fuel tanks are not to be fitted unless the cock or drain valve be of self-closing type.

(*g*) All valves in connection with the oil fuel apparatus are to be so constructed as to prevent the possibility of any cover being slacked back or loosened when operating the valves.

8. **Control of Pumps.**—The motive power of the oil fuel transfer and unit pressure pumps, and the steam supply for the fire extinguishing apparatus, are to be capable of being controlled from a position which will always be accessible in the event of fire taking place in the compartment in which they are situated as well as from the compartment itself.

9. **Compartments for Storage of Fresh Water.**—The pipes in connection with compartments used for storing fresh water either for boilers or for drinking are to be separate and distinct from any pipes that may be used for oil or oily water and are not to be led through tanks which contain oil.

10. **Tanks for Carrying Oil or Water Ballast alternatively.**—(*a*) Where it is intended to carry oil fuel and water ballast in the same compartments alternatively, the valves or cocks connecting the suction pipes of these compartments with the ballast donkey pump, and those connecting them with the oil fuel transfer pump, are to be so arranged that the oil may be pumped from any one compartment by the oil fuel pump at the same time as the ballast donkey pump is being used on any other compartment. Where settling or service tanks are fitted of large capacity so that they do not require frequent replenishment, the above requirement may be dispensed with.

(*b*) In the case of deep tanks which can be used for oil fuel, water ballast or cargo, provision is to be made for blank flanging the oil fuel and water ballast filling and suction pipes when the tanks are being used for cargo, and for blank flanging the bilge suction pipes when the tanks are being used for oil fuel or for water ballast.

11. **Steam Heating Coils.**—(*a*) Where steam is used for heating the oil fuel, either in the bunkers, tanks, or heaters, the exhaust drains are to discharge the water of condensation into an observation tank where it can be seen whether or not it is free from oil.

(*b*) The steam heating pipes in contact with the oil fuel are to be of wrought iron or steel, and are to be tested, after being fitted on board, to twice their working pressure.

(*c*) The working pressure of the steam heating pipes is to be determined from the formulæ contained in **Section 13, clause 16,** of the **Rules for Engines and Boilers.**

12. **Ventilation.**—The spaces in which the oil fuel burning appliances and the oil fuel settling and service tanks are fitted are to be well ventilated and easy of access.

13. **General.**—(*a*) No wood fittings or bearers are to be fitted in the boiler rooms, or in the compartments containing the settling tanks.

(*b*) Savealls are to be fitted at the furnace mouths to intercept oil escaping from the burners.

(*c*) Bilge suction pipes of lead are not permissible in engine or boiler spaces where settling tanks or oil fuel appliances are situated.

(*d*) Water service pipes and hoses are to be fitted so that the stokehold plates and tank top under the boilers can at any time be flushed with sea water, and, in addition, steam from the auxiliary range of piping is to be led to pipes perforated for the emission of steam into the lower parts of the boiler room.

Where steam fire extinguishing apparatus is not fitted, equivalent apparatus is to be provided.

(*e*) The pumping arrangements of the oil fuel installations are to be submitted for approval.

OIL CARRIED AS CARGO IN DEEP TANKS AND PEAK TANKS.

Section 20A. Where it is desired that a special notation be made in the Register Book indicating that a deep tank or a peak tank is considered to be structurally suitable for the carriage of oil as cargo, the following requirements are to be complied with.

FUEL OIL.

1. **Flash Point.**—The flash point of the oil is not to be lower than 65,5° C.

2. **Scantlings and Riveting.**—(*a*) The arrangement of stiffening, the scantlings, the riveting, the standard of workmanship and the system of testing are to be as prescribed for oil fuel bunkers.

(*b*) The arrangement of washplates is to be as required for water ballast tanks. In deep tanks, the decks are to be supported by an intercostal girder on each side of the middle line. Special attention is to be paid to the riveting at the heads and heels of the quarter pillars.

3. **General.**—The arrangements for ventilation and drainage, fittings and control are to be as required for oil fuel bunkers.

4. **Notation.**—The notation to be made in the Register Book will be: "Carrying Fuel Oil, F.P. above 150° F. in Deep and/or Peak Tanks," as the case may be.

VEGETABLE OIL.

1. **Scantlings and Riveting.**—The scantlings, arrangements and riveting, and the system of testing, may be as required for deep tanks carrying water ballast.

2. **General.**—The arrangements for ventilation and drainage, fittings and control are to be as required for oil fuel bunkers.

3. **Notation.**—The notation to be made in the Register Book will be: "Carrying Vegetable Oil in Deep and/or Peak Tanks" as the case may be.

4. **Loading Test.**—Before a cargo of oil is loaded the tank should be tested under water pressure and examined for cleanliness to ensure that it is in a proper condition to receive the oil cargo.

NON-WATERTIGHT BULKHEADS.

Section 21. 1. **Middle Line Bulkheads.**—(*a*) The thickness of the plating is to be 7,5 mm. in the holds, and 6,5 mm. in the 'tween decks. The bulkhead is to be attached at the top and bottom by single angle bars 2,5 mm. thicker than the bulkhead plating.

(*b*) The vertical stiffeners are to be of the sizes given in **Table 35,** and may be fitted two frame spaces apart provided the frame spacing does not exceed 760 mm. Where the frame spacing is greater than 760 mm. the stiffeners are to be fitted on every frame and the scantlings may be correspondingly reduced.

Where quarter pillars are fitted the stiffeners may be reduced in strength by 20 per cent.

(*c*) The stiffeners at the ends of the hatchways are to be bracketed at top and bottom, and where reinforced hatchway end beams are fitted, these stiffeners are to be doubled or equivalent arrangements provided. The remainder of the stiffeners are to be riveted to the beams and are to be attached at the bottom by double riveted lugs.

2. **Bunker Bulkheads.**—(*a*) The thickness of the plating and the scantlings of the bars at top and bottom of longitudinal vertical bunker bulkheads are to be as required for the middle line bulkheads except that the lowest strake, which is to extend at least 610 mm. above the level of the stokehold floor, is to be 9 mm. in thickness.

(*b*) The vertical stiffeners of longitudinal bulkheads which act as supports to the deck are to be of the sizes given in **Table 35.**

(*c*) Where longitudinal bulkheads do not act as supports to the deck the stiffeners are to be of the sizes given in **Table 35.**

(*d*) The stiffeners are to be fitted two frame spaces apart provided the frame spacing does not exceed 760 mm. Where the frame spacing is greater than 760 mm. the stiffeners are to be fitted on every frame, and the scantlings may be correspondingly reduced.

(*e*) The plating of transverse bunker bulkheads is to be as required for longitudinal bulkheads, and the stiffeners, which are to be spaced 910 mm. apart, are to be in accordance with the requirements of **Table 35.**

(*f*) Where sloping bunker casings are fitted, the scantlings of the stiffeners are to be suitably increased, and the stiffeners are to be additionally supported from the deck beams by angle stays, attached by brackets to the deck beams and the casing stiffeners.

DETACHED SUPERSTRUCTURES.

Section 22. 1. **"Short" Deck Superstructures.**—(*a*) The scantlings of poops, forecastles and "short" bridges (*i.e.*, bridges of which the length does not exceed 15 per cent of the length of the vessel) are to be in accordance with the requirements of **Table 25.**

(*b*) All vessels are to have forecastles except in cases in which the scantlings of the vessel do not exceed the requirements for complete superstructure vessels. Where the conditions of service may necessitate the omission of the forecastle, additional sheer is to be provided as may be required by the Committee.

(*c*) Where steel decks are fitted on poops, short bridges or forecastles, the thickness is not to be less than in the following Table, except that steel decks which are sheathed need not exceed the thickness given in **Table 25** for stringers and tie-plates.

	Beams at every frame.	Beams at alternate frames.
	mm.	mm.
Sheathed ...	6,5	7,5
Unsheathed ...	7,5	8,5

The thickness of plating given for forecastles in **Table 25** is applicable to unsheathed decks with beams fitted at every frame. Where the decks are sheathed a reduction of 1,5 mm. may be permitted in the thickness of the plating, provided a minimum of 6,5 mm. is maintained.

(*d*) The seams of the side and deck plating and the butts of the side plating, stringer plates, deck plating, and tieplates may be single riveted.

2. **"Long" Bridges.**—(*a*) Where the length of the bridge exceeds 15 per cent of the length of the vessel, the scantlings are to be as required by **Tables 22** and **23**.

(*b*) The riveting of the butts and seams of the deck plating and of the side plating is to be as required by **Table 39**. The riveting of the seams of bridge side plating need not exceed the riveting of the side shell plating but the seams are in every case to be double riveted for four frame spaces at the ends.

3. **Framing.**—Partial bulkheads are to be fitted in bridges below large deckhouses, which bulkheads are to be in continuation of watertight bulkheads fitted below. Partial bulkheads may also be required to be fitted at other places.

4. **Strengthening at ends of Poops, Forecastles and Bridges.**—(*a*) **Bridges.** At each end of a bridge the upper deck sheerstrake and the upper deck stringer plate are to be increased in thickness by 50 per cent in the case of long bridges and 30 per cent at short bridges. In way of a long bridge the sheerstrake, strake below and the upper deck plating, as fitted in the wells, are to be extended within the ends of the bridge for a distance equal to one-third the breadth of the vessel. The bridge side plating is to be extended beyond the ends of the bridge and is to be supported by plate webs spaced not more than 1,5 m. from the ends of the bridge. The bulwark rail is to be connected to the bridge end bulkheads by substantial bracket plates, and similar bracket plates are to be fitted on the inner side of the bulkhead.

(*b*) **Poops and Forecastles.** The additional strengthening prescribed above is to be fitted at the fore end of a poop or at the after end of a forecastle, wherever the length exceeds 25 per cent of the length of the vessel.

5. **Poop and Bridge Front Bulkheads.**—(*a*) Bulkheads at the fore end of bridges, and of unprotected poops the length of which is 40 per cent or more of the length of the vessel are to have a thickness of 7,5 mm. in vessels 61 m. in length and under, and 11 mm. in vessels 116 m. in length and above.

(*b*) The bulkheads are to be stiffened with bulb angles of the sizes given in the following Table:—

Length of Ship.	Size of Bulb Angle Stiffeners.	Number of Rivets in Lugs.	Length of Ship.	Size of Bulb Angle Stiffeners	Number of Rivets in Lugs.
m. under	mm.		m.	mm.	
49	140 × 75 × 7,5	3	109,8	220 × 75 × 10,5	5
49	150 × 75 × 8	3	122	230 × 75 × 11	5
61	170 × 75 × 8,5	4	134,2	240 × 90 × 11,5	5
73,2	180 × 75 × 9	4	146,2	250 × 90 × 12	5
85,4	190 × 75 × 9,5	4	158,6	270 × 90 × 12,5	6
97,6	200 × 75 × 10	5	170,8	280 × 90 × 13	6

The stiffeners are to be spaced 760 mm. apart, and efficiently connected to the deck plating at top and bottom by lugs having the number of rivets in each flange specified in the Table.

(*c*) Bulkheads at the fore end of bridges not covering deck openings are to have plating of the thickness required by **paragraph** (*a*), but the stiffeners may be 10 per cent less in depth than given by **paragraph** (*b*).

(*d*) Bulkheads of poops partially protected or less in length than 40 per cent of the length of the vessel are to have a thickness of 6 mm. in vessels 49 m. in length and under, and 9,5 mm. in vessels 122 m. and above in length. The bulkheads are to be stiffened by plain angles of the size given in the following Table, spaced 760 mm. apart, and connected to the deck plating at top and bottom by lugs having the number of rivets in each flange specified in the Table:—

Length of Ship.	Size of Angle Stiffeners.	Number of Rivets in Lugs.	Length of Ship.	Size of Angle Stiffeners.	Number of Rivets in Lugs
m. under	mm.		m.	mm.	
45,7	75 × 65 × 7,5	2	106,7	140 × 75 × 10,5	3
45,7	90 × 65 × 8	2	122	150 × 75 × 11	3
61	100 × 75 × 8,5	2	137,2	170 × 90 × 11,5	3
76,2	120 × 75 × 9	2	152,5	180 × 90 × 12	4
91,5	130 × 75 × 9,5	3	167,7	180 × 90 × 12,5	4

6. **Bulkheads at After End of Bridges and Forecastles**:—The plating of bulkheads at the after end of bridges and forecastles is to be 5 mm. in thickness in vessels 49 m. in length and under, and 7,5 mm. in vessels 122 m.

and above in length. The bulkheads are to be stiffened by plain angles of the size given in the following table, spaced 760 mm. apart.

Length of Ship.	Size of Angle Stiffeners
m.	mm.
under 45,7	65 × 65 × 6,5
45,7	75 × 65 × 7
76,2	90 × 75 × 7,5
106,7	100 × 75 × 8

7. **Deckhouses.**—(*a*) All deckhouses on upper decks, or on decks of superstructures, are to be of sufficient strength and, where the length of the deckhouse exceeds 10 per cent of the length of the vessel, plans showing the scantlings and arrangements are to be submitted for approval.

(*b*) The sides and ends of large deckhouses are to be supported by partial bulkheads and web frames, together with intermediate vertical stiffeners. The spacing of the partial bulkheads, or webs, is not to exceed 9 m. and, where possible, these are to be fitted above the structural bulkheads of the vessel.

Web frames should also be fitted, where possible, at the sides of large doors.

(*c*) Care is to be taken, as far as possible, to minimise the effects of all discontinuities in the structure of deckhouses. Continuous coamings are to be fitted below and above doors and other openings, and the corners of all openings cut in the sides of deckhouses should be well rounded.

(*d*) The tops of the deckhouses are to be efficiently supported by beams of suitable scantlings, and the beams should, as far as possible, be fitted in line with the side stiffeners and be connected to them by bracket knees. In all vessels exceeding 91,5 m. in length where the top of the house forms the weather deck above passenger accommodation the beams are to be completely plated over the accommodation.

(*e*) The deckhouse sides are to be additionally stiffened in way of boats and the decks strengthened in way of the davits.

RAISED QUARTER DECKS.

Section 23. 1. **Scantlings.**—(*a*) In vessels of the raised quarter deck type the scantling numerals and moulded depth are to be taken to the upper deck.

(*b*) The scantlings and arrangements of the side framing in way of the raised quarter deck are to be determined by the moulded depth of the vessel taken to the upper deck in association with the framing depth (**d**) taken in way of the raised quarter deck.

(*c*) The scantlings of the raised quarter deck stringer and plating, sheerstrake and strake below, are to be as required by the Tables for a vessel having a longitudinal numeral calculated as in **paragraph** (*a*) in association with a proportion of length to depth taken to the raised quarter deck, but no addition need be made to the thickness of the deck stringer and plating on account of proportion of length of vessel covered by superstructures.

2. **Break Bulkhead.**—The front or break bulkhead of the raised quarter deck is to have the thickness of the plating required for bridge front bulkheads, and is to be efficiently stiffened.

3. **Strengthening at Break.**—(*a*) The upper deck stringer plate is to extend abaft the break about four frame spaces, and the raised quarter deck stringer plate is to be extended about three frame spaces forward of the break ; the bridge stringer is also to be extended abaft the break.

(*b*) In vessels which require a steel deck or part steel deck, the upper deck plating is to scarph the raised quarter deck for a length of two to three frame spaces according to the size and proportions of the vessel, and the upper deck stringer plate is to extend two or three frame spaces abaft the deck plating.

(*c*) Sufficient diaphragm plates are to be fitted, of the thickness of the break bulkhead plating, to connect the two decks. They are to be attached to the decks and bulkhead by double angles, and are to be stiffened by an angle on the after edge and vertical stiffeners where necessary.

(*d*) The upper deck sheerstrake is to be increased in thickness and is to be extended for a reasonable distance abaft the break. In the case of a raised quarter deck connected to a long bridge the raised quarter deck sheerstrake is to be increased in thickness, and the bulwark plates of the raised quarter deck adjoining the bridge side plating are also to be increased in thickness.

CRUISER STERNS.

Section 24. 1. **Length.**—Where vessels have cruiser sterns, the length (**L**) of the vessel is to be measured in the manner required by **Section 3, clause 1.**

2. **Framing.**—(*a*) The frames abaft the after perpendicular are to be spaced 610 mm. apart, and are to be of the size required for bulb angle frames in peaks, and are to extend to the strength deck.

(*b*) Floor plates are to be of a reasonable depth, depending upon the form of the vessel, and are to be supported at the centre line by an intercostal girder.

(*c*) Additional stiffening in the form of web frames and longitudinal girders is to be provided as may be necessary.

3. **Beams.**—Beams are to have the scantlings required by the Rules for the respective decks.

4. **Plating.**—The plating round the cruiser stern is to be of the thickness required by **Tables 18** and **19** for side shell plating at ends. The riveting of the landing edges and butts is to be the same as that of the corresponding strakes of shell plating at ends, but the edges and butts are not to be less than double riveted up to the strength deck.

5. **Pillaring.**—Pillaring arrangements are to be fitted to the satisfaction of the Surveyors.

HATCHWAYS AND DECK OPENINGS.

Section 25. 1. **Height of Coamings.**—The minimum height of coamings above decks is to be as follows:—

On upper decks, except as qualified below, where exposed to weather ...		610 mm.
On upper decks of vessels whose draught does not exceed that which could be assigned as a Complete Superstructure vessel, on raised quarter decks and on decks of superstructures where exposed to the weather ...	When within 25 per cent of the vessel's length from the stem	610 mm.
	When aft of the above ...	460 mm.
On decks inside superstructures the openings in the latter having no means of closing		460 mm.
On decks inside superstructures the openings in the latter being closed by strong hinged wood doors or wooden shifting boards fitted in channels or equivalent		230 mm.

On decks below the upper deck, or within an intact superstructure, the coaming plates need not extend above the deck, but in such cases an angle coaming is to be fitted round these hatchways; all openings in decks are required to be framed.

2. **Thickness of Coamings.**—(*a*) **In hatchways on the upper deck or on superstructure decks** where exposed to the weather, the side and end coamings are to be not less than 11 mm. in thickness in vessels exceeding 61 m. in length. For vessels 30 m. long, the coamings are to be 9 mm. in thickness, and for vessels of intermediate length the thickness may be obtained by interpolation.

(*b*) **In hatchways below the upper deck, or within an intact superstructure,** the side and end coamings are not to be less than 10 mm. in thickness.

3. **Construction of Coamings.**—(*a*) Angles connecting coamings and deck plating are to be of the thickness of the coamings to which they are attached, and where a wood deck is fitted, the vertical flange is to extend 10 mm. above such deck.

The angles connecting the side and end coamings are to be of the thickness of the coamings.

(*b*) Hatchway coamings which are required by **clause 1** of this Section to extend above the deck, are to be caulked and made watertight, and the angles connecting these hatchway coamings to the deck plating are to be turned or welded at the corners.

(*c*) The side coamings of all hatchways are to extend to the lower edge of the beams.

(*d*) Hatchway side coamings, which are 610 mm. or more in height above the deck, and which are above 3 m. in length, are to be stiffened by horizontal bulb angles, not less than 180 mm. in depth, fitted near their upper edges.

Where hatchways exceed 3,0 m. in breadth, the end coamings are to be similarly strengthened, or be made equivalent thereto, unless the end coamings are adequately protected by the deck erections.

Additional support is to be afforded by fitting brackets or stays from the bulb angle to the deck at intervals of not more than 3 metres. Where the coamings are 910 mm. in height and above, plans showing the construction are to be submitted for approval.

(*e*) Where the pillars abreast the hatchways are spaced more than 4 frame spaces apart, or where the line of pillars at sides of hatchways is more than 460 mm. from the coamings, the coamings will require to be made sufficiently strong as a girder to support the deck load, and plans of such cases are to be submitted for approval. (*See* **Section 16.**)

4. **Hatchway Beams.**—(*a*) At hatchways which are required by **paragraph 1** to be 610 mm. in height, the hatchway beams and fore and afters are to be of the sizes given in **Table 36A** in vessels 61 metres and more in length. In vessels not exceeding 30,5 metres in length the scantlings may be taken from **Table 36B**.

At weather deck hatchways which are required to be 460 mm. in height, the beams and fore and afters may be of the sizes given in **Table 36B**.

At 'tween deck hatchways the scantlings are to be in accordance with **Table 36A** except in spaces fitted exclusively for the accommodation of passengers when they may be as given in **Table 36B**.

In no case are hatchway beams to be more than 3 metres apart.

(*b*) Where the height of 'tween decks exceeds 2,60 m. the scantlings of the hatchway beams and covers are to be suitably increased.

(*c*) The web plate beams are to be stiffened at their upper and lower edges by double angles, of the size required by **Tables A** and **B** except where bulb plates are fitted, when the top angles only are required. The angles at the upper edges are to extend to the extreme ends in all cases, and are not to be recessed where fore and afters are fitted.

The ends of the web plates are to be flushed up on each side by doubling plates, having the same thickness as the angle mountings, and at least 180 mm. wide.

Where no fore and afters are fitted, the alternate web plates are to extend to the top of the wood hatches.

(*d*) **Steel fore and afters** are to have angle mountings at the upper edges, as required by **Table 36**, and these mountings are to extend to the extreme ends in all cases.

Bearing pieces of heavy angle bar are to be fitted on the lower edge in way of each hatchway beam which they cross.

(*e*) **Wood fore and afters** are to be of pitch pine, or other wood of not less hardness and strength, and are to be free from defects. Steel shoes, at least $180 \times 12,5$ mm. are to be fitted at each end of wood fore and afters, and plate bearing pieces, at least $230 \times 12,5$ mm. in way of each hatchway beam which they cross.

5. **Carriers.**—(*a*) All hatchway beams and fore and afters are to be efficiently supported at their ends by steel carriers, with a length of bearing of not less than 75 mm.; they are to be fitted close to the sides and throat of the hatchway beams and fore and afters. Where carriers are of angle bars they are to be not less than 12,5 mm. in thickness, and one bar of each carrier is to extend at least to the level of the deck.

(*b*) Where the carriers adopted are of a form such as will not permit them to be extended to the deck, the thickness of the hatchway side coaming must be increased.

(*c*) Where fore and afters extend across hatchway beams, strong lugs are to be fitted on the beam to keep the fore and afters in position.

(*d*) The bottoms of all carriers are to be solid, or are to be efficiently secured by not less than two 22 mm. rivets.

6. **Hatch Covers.**—(*a*) Hatch covers are to be fitted to the hatchways in way of all laid decks. Solid covers are to have a finished thickness of 60 mm. in association with an unsupported span of 1·5 m. Where grating covers are fitted they are to be of sufficient strength.

(*b*) Where it is desired to adopt a wider spacing of beams than given above, the thickness of the covers is to be increased and is to be not less than 75 mm. where the unsupported span is 1·80 m.

(*c*) Hatch covers may be dispensed with at decks below the upper deck or within an intact superstructure, as defined in the last paragraph of **clause 1**, if desired by the owners, and, in any case where they are so dispensed with, the Certificate of Classification will be suitably endorsed, and a corresponding notation made in the Register Book.

7. **Hatch Rests.**—Hatch rests are to be at least 65 mm. wide and, where necessary, the hatch rests are to be bevelled so as to provide bearing surface not less than that width.

8. **Cleats, Battens, and Tarpaulins.**—Cleats, not more than 610 mm. apart centre to centre, are to be fitted to the coamings of all hatchways on or above the upper decks, unless such hatchways are within an intact superstructure; the end cleats are to be placed not more than 150 mm. from the hatchway corners. They are to be of strong section, at least 65 mm. wide, and are to be attached by not less than two rivets.

Tarpaulins in good condition, free from jute, thoroughly waterproofed and of ample strength are to be provided for all hatchways on superstructure decks, in exposed positions on upper decks, and within superstructures which are not permanently enclosed. Not less than two tarpaulins are to be provided to all hatchways in exposed positions.

Battens and wedges are to be efficient and in good condition.

At all hatchways in exposed positions on weather decks, ring bolts or other fittings for lashings are to be provided.

Where the breadth of the hatchway exceeds 60 per cent of the breadth of the deck in way of the hatchway and the coamings are required to be 610 mm. in height, fittings for special lashings are to be provided for securing the hatchway covers after the tarpaulins are battened down.

9. **Bunker Hatchways.**—The minimum heights of coamings of these hatchways are to be in accordance with **clause 1,** and covers, beams, and battening down arrangements as effective as those required for cargo hatchways are to be fitted. If the deck beams in way of these openings are cut, fore and aft coaming plates are to be fitted to take the beam ends.

10. **Flush Bunker Scuttles.**—Flush bunker scuttles may be fitted in the following positions:—

(*c*) Where escape scuttles are fitted in the 'tween decks and on decks within intact superstructures, the openings are to be provided with angle coamings, and wood covers are to be fitted. This requirement may be modified to suit special conditions of trade on application being made to the Committee by the Owners.

12. **Trunked Hatchways.**—Where hatchways are trunked through one or more 'tween decks, and the hatchway beams and covers are dispensed with at the intermediate decks, the hatchway beams, fore and afters, coamings and deck immediately below the trunk are to be adequately strengthened, and in such cases plans are to be submitted for approval.

Where the trunkways are intended to take the place of 'tween deck pillars in way of the hatches, they are to be of steel and are to be efficiently stiffened.

13. **Companions.**—Companions on exposed decks should be of steel and be securely riveted to the deck

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Received by Chief Engineer Surveyor .....

Received from Chief Engineer Surveyor .....

LON 113328
Rpt. SOU No 18632
MDR 17966

VESSEL'S NAME BENLAWERS

The remarks of the Chief Engineer Surveyor are desired on this case for the consideration of the Classing Committee.

("The endorsement to contain a succinct summary of any repairs that have been required and to show the cause or causes of such repairs, and also to bring out clearly any exceptional features in connection with the case, so that the Classing Committee may have all the salient points presented in the endorsement."—*Extract from Sub-Committee's Report*, 24/5/92.)

Nature of Survey DAMAGE & WEAR AND TEAR.

Damage (See LON 112754) Propeller repaired.
Wear & Tear Fwd Freeing Gear pump repaired
after do do overhauled
Screw Shaft examined 12-415.

It is submitted the vessel is eligible to remain as classed, with record of Survey S. 12-415 as recommended.

4. **Hatchway Beams.**—(*a*) At hatchways which are required by **paragraph 1** to be 610 mm. in height, the hatchway beams and fore and afters are to be of the sizes given in **Table 36A** in vessels 61 metres and more in length. In vessels not exceeding 30,5 metres in length the scantlings may be taken from **Table 36B**.

At weather deck hatchways which are required to be 460 mm. in height, the beams and fore and afters may be of the sizes given in **Table 36B**.

At 'tween deck hatchways the scantlings are to be in accordance with **Table 36A** except in spaces fitted exclusively for the accommodation of passengers when they may be as given in **Table 36B**.

In no case are hatchway beams to be more than 3 metres apart.

(*b*) Where the height of 'tween decks exceeds 2,60 m. the scantlings of the hatchway beams and covers are to be suitably increased.

(*c*) The web plate beams are to be stiffened at their upper [illegible] by double angles of the size required by beams and fore and afters. Where carriers are of angle bars they are to be not less than 12,5 mm. in thickness, and one bar of each carrier is to extend at least to the level of the deck.

(*b*) Where the carriers adopted are of a form such as will not permit them to be extended to the deck, the thickness of the hatchway side coaming must be increased.

(*c*) Where fore and afters extend across hatchway beams, strong lugs are to be fitted on the beam to keep the fore and afters in position.

(*d*) The bottoms of all carriers are to be solid, or are to be efficiently secured by not less than two 22 mm. rivets.

6. **Hatch Covers.**—(*a*) Hatch covers are to be fitted to the hatchways in way of all laid decks. Solid covers are to have a finished thickness of 60 mm. in association with an unsupported span of 1·5 m. Where grating covers are fitted they are to be of sufficient strength.

(*b*) Where it is desired to adopt a wider spacing of beams than given above, the thickness of the covers is to be increased and is to be not less than 75 mm. where the

Battens and wedges are to be efficient and in good condition.

At all hatchways in exposed positions on weather decks, ring bolts or other fittings for lashings are to be provided.

Where the breadth of the hatchway exceeds 60 per cent of the breadth of the deck in way of the hatchway and the coamings are required to be 610 mm. in height, fittings for special lashings are to be provided for securing the hatchway covers after the tarpaulins are battened down.

9. **Bunker Hatchways.**—The minimum heights of coamings of these hatchways are to be in accordance with **clause 1,** and covers, beams, and battening down arrangements as effective as those required for cargo hatchways are to be fitted. If the deck beams in way of these openings are cut, fore and aft coaming plates are to be fitted to take the beam ends.

10. **Flush Bunker Scuttles.**—Flush bunker scuttles may be fitted in the following positions:—

(*a*) On bridge decks, poop decks, raised quarter decks, or on upper decks of complete superstructure vessels having tonnage openings.

(*b*) In positions which are always accessible on decks inside superstructures where the openings in the latter are closed with efficient closing appliances.

The scuttles are to be of iron or steel, of substantial construction, and are to have screw or bayonet joints. Where the scuttles are not secured to the frames by hinges, a permanent chain attachment is to be provided.

11. **Escape Scuttles.**—(*a*) Where escape scuttles are fitted on the weather decks, strong coamings having a minimum height above the deck, as required by **clause 1,** are to be fitted, and are otherwise to comply generally with the requirements of this Section.

(*b*) Where escape scuttles are fitted on decks inside superstructures, the openings in the latter being closed by strong hinged wood doors or wood shifting boards fitted in channels or equivalent, the scuttles are to be provided with either

1. Strong coamings 230 mm. in height with weathertight wood covers,

or

2. Angle coamings with hinged watertight steel covers secured by strong backs or closely spaced bolts and nuts.

(*c*) Where escape scuttles are fitted in the 'tween decks and on decks within intact superstructures, the openings are to be provided with angle coamings, and wood covers are to be fitted. This requirement may be modified to suit special conditions of trade on application being made to the Committee by the Owners.

12. **Trunked Hatchways.**—Where hatchways are trunked through one or more 'tween decks, and the hatchway beams and covers are dispensed with at the intermediate decks, the hatchway beams, fore and afters, coamings and deck immediately below the trunk are to be adequately strengthened, and in such cases plans are to be submitted for approval.

Where the trunkways are intended to take the place of 'tween deck pillars in way of the hatches, they are to be of steel and are to be efficiently stiffened.

13. **Companions.**—Companions on exposed decks should be of steel and be securely riveted to the deck.

14. **Mast Holes.**—In way of mast wedging, where iron or steel decks are not fitted, plates are to be riveted to the beams, of not less thickness than is required for stringer plate amidships, and of not less width than three times the diameter of the mast.

VENTILATORS.

Section 26. 1. **Number and Size.**—Ventilators sufficient in number and size are to be efficiently fitted to weather decks of all vessels.

2. **Ventilator Coamings.**—(*a*) Where exposed to the weather the minimum height of coamings of ventilators to cargo spaces is to be 910 mm. on upper decks, except as qualified below. On upper decks of vessels whose draught does not exceed that which could be assigned as a Complete Superstructure Vessel, on raised quarter decks and on decks of other superstructures, the minimum height of coaming is to be 760 mm. except on superstructure decks within one-fourth of the vessel's length from stem where the height is to be 910 mm.

If ventilator coamings are fitted of a greater height than 910 mm. and are not efficiently supported by adjacent structures, they are to be strongly stayed or bracketed to the deck.

(*b*) The scantlings of the coamings and their attachment to the deck are to be in accordance with the following Tables :—

Ventilator Coamings.		
Internal Diameter of Ventilator Coaming.	Coaming Plate.	Deck Bar.
mm.	mm.	mm.
150 and not exceeding 200	7,5	75 × 75 × 8,5
Above 200 „ „ 220	8	75 × 75 × 9
„ 220 „ „ 320	8,5	90 × 90 × 9,5
„ 320 „ „ 380	9	90 × 90 × 10
„ 380 „ „ 430	9,5	90 × 90 × 10,5
„ 430	10	90 × 90 × 11

The rivets in these bars are to be 19 mm. diameter for ventilators not exceeding 380 mm. in diameter, and 22 mm. for ventilators greater than this diameter, and are to be spaced 4 diameters apart, centre to centre.

(*c*) A steel ring may be riveted to the outside of the coaming to provide a proper bearing for the cowl, and the housing is to be not less than 380 mm.

(*d*) In cases where a steel deck is sheathed with wood the coaming is to be riveted direct to the steel deck, and the vertical flange of the bar is to extend at least 10 mm. above the wood sheathing.

3. **Stiffening of Deck below Ventilators.**—The deck plating in way of the ventilators is to be efficiently stiffened between the beams.

4. **Covers.**—All ventilator coamings are to be provided with strong plugs and canvas covers or equally efficient appliances for closing the openings when the cowls are unshipped.

5. **Mushroom and Gooseneck.**—Such ventilators when fitted to accommodation spaces are to be substantially constructed and efficiently bolted to the deck plating.

6. **Scuttles in Topsides.**—Side scuttles to spaces below the freeboard deck or to spaces within enclosed superstructures are to be fitted with efficient inside deadlights, permanently attached and capable of being closed watertight.

In enclosed superstructures permanently allocated to passengers or to crew, portable deadlights may be provided if stowed beside the scuttles.

7. **Mechanical Ventilation.**—Where a system of mechanical ventilation is adopted, sketches showing the construction of the tanks, fan casings and so forth, on the weather deck are to be submitted for approval.

8. **Alternative arrangements.**—Should the owners desire it, other arrangements proportionate to those prescribed in this Section may be adopted.

ENGINE AND BOILER SPACE.

Section 27. 1. **Engine and Boiler Bearers.**—(*a*) Engine and boiler bearers are to be of substantial construction and are to be efficiently supported by brackets, both longitudinally and transversely.

(*b*) Where engines are bolted direct to the inner bottom, the thickness of the plating under the engines is to be suitably increased.

(*c*) In single bottom vessels the floors in the engine space are to be increased in depth.

(*d*) In all vessels additional fore and aft girders are to be fitted in way of the engine seating and thrust block seating and are to be attached to the shell.

(*e*) Where it is intended to fit engines of special type or of greater power than in ordinary cargo carrying steamers, the engine seating is to be proportionately increased, and plans are to be submitted for approval.

2. **Additional strengthening in Machinery Space.**—Additional transverse strengthening by means of web frames and strong beams, or otherwise, is to be provided in the machinery space.

3. **Clearance between Bulkheads and Boilers.**—Coal bunker and hold bulkheads are to be kept well clear of boilers and uptakes.

Where the boiler room bulkhead is recessed for a boiler, the recess is to be of a size sufficient to provide space all round the boiler for proper access.

The roof of the recess is not to be less than 1,20 m. clear of the top of the boiler, the space between the bunker plating and the uptake is not to be less than 460 mm., and a baffle plate is to be fixed between the uptake and the bulkhead, or other efficient means are to be provided.

Uptakes and flat surfaces of boilers are not to be less than 460 mm., and cylindrical shells of boilers are not to be less than 230 mm., from coal bunker and hold bulkheads.

4. **Protection of Deck under Donkey Boilers.**—Where donkey boilers are placed on the decks of vessels the deck underneath is to be increased 2,5 mm. in thickness, and is to be protected by being covered with firebrick or cement not less than 50 mm. in thickness. A similar increase in thickness and means of protection are to be fitted to decks on which fires may be drawn from any donkey boiler.

ENGINE AND BOILER OPENINGS.

Section 28. 1. **Extent and Construction of Machinery Casings.**—(*a*) Engine and boiler openings on the weather deck are to be protected by properly framed casings of substantial construction.

(*b*) The minimum height of casings on upper decks, except as qualified below, is to be 1,80 m. in vessels not exceeding 82 m. in length, and 2,30 m. in vessels 122 m. in length and above.

(*c*) On upper decks of vessels whose draught does not exceed that which could be assigned as a Complete Superstructure Vessel, and on decks of superstructures where exposed to the weather, the height of the casing is not to be less than 0,76 m.

(*d*) The engine and boiler openings should be made as small as practicable, and as many cross ties as possible are to be fitted at each deck. The tops of the side casings are to be efficiently connected by beams and plating.

(*e*) In the cases of vessels referred to in **paragraph** (*b*) above, the thickness of the casings is not to be less than 6,5 mm. for vessels 30 m. in length; 7,5 mm. in vessels 61 m. in length; and 8,5 mm. in vessels 91 m. and above in length; for vessels included in **paragraph** (*c*) above, the thickness of the casings is to be 6,5 mm. in vessels up to 61 m. in length, and 7,5 mm. in vessels 91 m. and above in length; the coaming plates are to be 1 mm. thicker than the plating.

(*f*) For casings 2,30 m. in height, the stiffeners are to be spaced 760 mm. apart, and for the vessels referred to in **paragraph** (*b*) are to be $75 \times 65 \times 6,5$ mm. angle in vessels 30 m. in length; $100 \times 75 \times 7,5$ mm. angle in vessels 61 m. in length; and $120 \times 75 \times 7,5$ mm. angle in vessels 91 m. and above in length; for all vessels included in **paragraph** (*c*) the stiffeners are to be $75 \times 75 \times 7,5$ mm. angle.

(*g*) The doors in casings on upper decks, except where the draught of the vessel does not exceed that which could be assigned as a Complete Superstructure Vessel, and on raised quarter decks are to be of steel, substantially constructed, permanently attached and capable of being closed and secured from both sides.

2. **Trunk Casings.**—Where the engine and boiler openings in the 'tween decks are enclosed by trunk casings they are to have 6,5 mm. plating and 7,5 mm. coamings and are to be suitably stiffened. Where the casings form the boundary of coal bunkers, the requirements of **Section 21** are to be complied with.

3. **Skylights and Gratings.**—Engine room skylights are to be substantially constructed, and are to be securely bolted or riveted to the coamings.

Grating openings over stokehold are to be protected by hinged plate covers.

FREEING PORTS, SCUPPERS AND SANITARY DISCHARGES.

Section 29. 1. **Freeing Ports.**—(*a*) Where weather decks are enclosed by bulwarks, ample provision is to be made for rapidly freeing the decks from large quantities of water.

(*b*) The area of the openings provided for this purpose in the bulwarks at the upper decks of full scantling vessels and at raised quarter decks, irrespective of the height of the bulwarks, is to be in accordance with the following Table:—

Length of Well.	Area on each Side.	Length of Well.	Area on each Side.
m.	m².	m.	m².
4,6	0,74	16,8	1,12
7,6	0,84	19,8	1,21
10,7	0,93	22,8	1,40
13,7	1,02	25,8	1,58

On other superstructures of standard height the area should be one-half of that required in the Table.

(*c*) The lower edges of the freeing ports are to be as near the deck as practicable and all such openings are to be protected by rails or bars spaced not more than 230 mm. apart. If hinged doors are also fitted over the openings, their hinges are to have brass pins and there are not to be any fittings for keeping the doors closed.

2. **Scuppers.**—(*a*) Scuppers sufficient in number and size to provide thoroughly effective drainage are to be fitted in all decks.

(*b*) Where the weather deck stringer angle is cut in way of scuppers, a compensating bar is to be fitted below the stringer plate.

(*c*) Scupper pipes from spaces below the bulkhead deck are either

(1) to be led to the bilges, or

(2) may be led overboard provided a screw-down automatic non-return valve be fitted, capable of being operated from above the freeboard deck from a position which is always accessible. Means should be provided for showing whether the valve is open or closed.

Similar arrangements may be required when scuppers are led from permanently enclosed spaces above the bulkhead deck.

Scupper pipes from superstructures which are permanently closed at the forward end, but which have temporary closing appliances at the after end, are to be fitted to drain overboard, with the exception of the scuppers within the range of the machinery space, which may be led and drained to the bilges of the machinery space. Scuppers which drain overboard are to be fitted with storm valves, or some other approved appliances.

Scupper pipes from superstructures which have temporary closing appliances at the forward end are to be led overboard and fitted with storm valves or some other approved appliances.

3. **Sanitary Discharges.**—Sanitary discharges from spaces below the freeboard deck are to be provided with efficient and accessible means for preventing water from passing inboard. Each discharge is to be provided with a screw-down automatic non-return valve capable of being operated from an accessible position above the freeboard deck. Means should be provided for showing whether the valve is open or closed.

Alternatively two automatic non-return valves, without positive means of closing, may be fitted provided the upper valve is in a position which is always accessible for examination under service conditions.

Similar arrangements may be required at sanitary discharges from spaces within enclosed superstructures.

4. **Storm Valves.**—Non-return valves are to be fitted in substantial metal castings other than cast iron. The lower length of pipe is to be iron or steel, galvanised and of substantial thickness, not less than standard steam pipe quality.

5. **Protection of Pipes in Holds and Bunkers.**—Where passing through cargo or bunker spaces, the pipes are to be protected by a substantial casing which is to be of steel in coal bunkers.

RIVETING.

Section 30. 1. **Arrangement of Rivets.**—(*a*) The size and spacing of the rivets in the various parts of the structure are to be in accordance with the requirements of **Tables 38** to **40.**

The diameter of the rivet is to be regulated in general by the greater thickness of the parts to be connected, but where the difference is considerable, special consideration will be given.

(*b*) Chain riveting is to be adopted for the butts of shell plating and for double and treble riveted joints, except for the connections to bar keel, stem, and sternpost.

2. **Form of Rivet.**—Rivets are to be increased in size under their heads in order to fill the rivet holes properly. Pan-headed rivets are to be of the form shown in **Table 39,** except were the holes have been drilled.

3. **Countersinking.**—(*a*) The rivet holes in the plating of the shell, weather decks, inner bottom and bulkheads of peak tanks and deep tanks, are to be countersunk.

(*b*) The countersinking of the rivet holes is to extend through the whole thickness of the plate or angle where the thickness does not exceed 12,5 mm. Above this thickness the countersinking is to extend through nine-tenths the thickness of the plate.

(*c*) The angles of countersink for plates whose thickness does not exceed 12,5 mm. is to be about 60 degrees and for plates exceeding this thickness the angle is be about 45 degrees.

4. **Spacing of Rows of Rivets.**—(*a*) The breadths of butt straps, end laps, and edge laps, are to be in accordance with the requirements of **Table 38.**

(*b*) Rivets are to be kept sufficiently clear of edges of material and of each other, and the distance from the centre of rivet hole to the edges of plating, butt straps, end laps, or angle bars, is not to be less than one-and-a-half rivet diameters.

The distance between the centres of consecutive rows of rivets is to be two-and-a-half rivet diameters for edge laps; three rivet diameters for butt straps; three-and-a-half diameters in end laps.

5. **Rivets in Seams of Shell Plating.**—(*a*) The riveting of the seams of shell plating is to be as required by **Table 40.**

(*b*) In vessels 84 m. and above in length the seams of the side shell plating are not to be less than double riveted.

(*c*) In vessels above 152,5 m. in length an additional pair of rivets is to be fitted in each frame space in three seams at about one-half the depth of the vessel for one-fourth of the vessel's length in the fore and after bodies. The actual position of this additional riveting is to depend on the arrangement of the shell plating and the special design of the vessel in each case. In vessels above 160 m. in length one of the above seams, and in vessels above 167,5 m. in length two of the above seams, are to be

treble riveted, the remaining seams or seam to be additionally riveted. Where the length of the vessel exceeds 183 m. the three seams are to be treble riveted.

Each case requiring this additional riveting is to be submitted for the approval of the Committee.

(*d*) In single riveted seams one frame rivet is to be fitted through the seams at each frame.

In double riveted seams one frame rivet is to be fitted through the seams at each frame, except where the frames or edges of the plating are joggled when two rivets are to be fitted.

In treble riveted seams two frame rivets (the upper and lower) are to be fitted through the seams at each frame.

6. **Spacing of Rivets.**—(*a*) All butt straps and end laps are to have complete rows of rivets.

(*b*) The rivets attaching the shell plating to the bottom frames are to be spaced as follows :—

Where the frame spacing does not exceed 800 mm., the rivet spacing is to be not more than 7 diameters.

Where the frame spacing exceeds 800 mm. but does not exceed 875 mm., the rivet spacing is to be not more than $6\frac{1}{2}$ diameters.

Where the frame spacing exceeds 875 mm., the rivet spacing is to be not more than 6 diameters.

(*c*) The rivets attaching the shell plating to the side frames are to be spaced as follows :—

Where the frame spacing does not exceed 725 mm., the rivet spacing is to be not more than 7 diameters.

Where the frame spacing exceeds 725 mm., but does not exceed 800 mm., the rivet spacing is to be not more than 6,5 diameters.

Where the frame spacing exceeds 800 mm., but does not exceed 875 mm., the rivet spacing is to be not more than 6 diameters.

Where the frame spacing exceeds 875 mm., the rivet spacing is to be not more than 5,5 diameters.

(*d*) Where the framing consists of an ordinary frame and reverse bar as provided for in **Tables 2, 3** and **4,** the rivets attaching the reversed bars to the frames are to have the same spacing as the rivets through the frames and shell plating.

(*e*) In deep tanks and in fore and after peak tanks, the rivets through the frames and shell plating are to be spaced not more than 5,5 diameters apart from centre to centre.

(*f*) Forward of the half length the rivets in both flanges of the frame angles connecting the floors to the shell plating are to be spaced not more than 5,5 diameters apart from centre to centre.

(*g*) At the stem, sternframe, and bar keel, rivets are to be 6 mm. larger in diameter than required for the thickness of the plating, but need not in any case exceed 28 mm. in diameter, and are to be spaced 5 diameters apart from centre to centre. In single screw steamers above 107 m. in length, the after lengths of the shell plating are to be connected to the portion of the stern frame below the boss with three rows of rivets.

(*h*) In the after peak, the rivets connecting the frames to the floors and cross ties are to be spaced not more than 5 diameters apart from centre to centre.

7. **Butt Straps.**—Where single butt straps are fitted, the straps are to be 25 per cent thicker than the plates to be connected. Where double straps are fitted, the thickness of the countersunk strap is to be 70 per cent, and the thickness of the strap on the opposite side 60 per cent of the thickness of the connected plates.

8. **Connection of Longitudinal Angles between Frames.**—The number of rivets between frames in each flange of the angle bars connecting stringer plates and intercostal plates to the shell plating is to be in accordance with the following Table :—

Frame Spacing.	Number of Rivets.
Not exceeding 660 millimetres	4
„ „ 760 „	5
„ „ 840 „	6
„ „ 910 „	7

9. **Breadths of Flanges of Bars.**—The breadths of the flanges of connecting angles are to be not less than 4 times the diameter of the rivet, for rivets up to 22 mm. in diameter, and 3,5 times for rivets 25 mm. and over in diameter.

10. **General.**—The riveting requirements in various parts of the structure are to comply with the regulations indicated by the following references :—

(*a*) **Framing.—Section 6, clause 7.**

(*b*) **Straps of Web Frame and Side Stringer Face Bars.—Section 7, clause 2.**

(*c*) **Tank Side Brackets.—Section 10, clause 8.**

(*d*) **Bottom Forward.—Section 11, clause 4.**

(*e*) **Wider Frame Spacing.**—Section 14, clause 9.

(*f*) **Beam Knees.**—Section 15, clause 3.

(*g*) **Half Beams to Coaming Plates.**—Section 15, clause 3.

(*h*) **Pillars and Girders.**—Section 16, clause 6.

(*i*) **Bulkheads.**—Section 17, clause 7.

(*j*) **Shaft Tunnels.**—Section 18, clause 5.

(*k*) **Deep Tanks.**—Section 19, clause 10.

(*l*) **Oil Fuel Bunkers.**—Section 20, Sub-Section B, clauses 6 and 7.

(*m*) **Oil Fuel Compartments.**—Section 20, Sub-Section C, clauses 2 and 3; Section 20A, clauses 1 and 2.

(*n*) **Detached Superstructures.** — Section 22, clause 1.

(*o*) **Ventilators.**—Section 26, clause 2.

CEILING AND CARGO BATTENS.

Section 31. 1. **Ceiling.**—(*a*) In single bottom vessels close ceiling is to be fitted from the centre keelson to the upper part of the bilges. The ceiling is to be made in hatches as far as practicable, but when not so arranged is to be fastened to the reversed frames in such a manner as to permit easy access for the purpose of survey, or for cleaning and painting.

(*b*) In vessels having double bottoms, ceiling is to be laid over the limbers at the bilges and under the hatchways. The ceiling at the limbers is to be readily removable for inspection of the bilges. Ceiling may be omitted under the hatchway provided the inner bottom plating is increased 2 mm. in thickness in way of the hatchways.

(*c*) Where the cargo is intended to be discharged by grabs or similar mechanical appliances, it is recommended that the ceiling be doubled or the inner bottom plating be increased 5 mm. in thickness.

(*d*) Where the covers or fittings of the manholes of the inner bottom in cargo holds project above the tank top, they are to be protected by an angle coaming around each manhole, fitted with a hatch either of wood or steel.

(*e*) If the ceiling be laid on the top of the plating, it is to be embedded in a substantial composition such as Stockholm tar and cement. If the ceiling be not so embedded, it is to be laid on battens 40 mm. thick to permit the drainage water to pass to the wells or bilges.

(*f*) The thickness of the wood ceiling is to be not less than 65 mm. in vessels exceeding 61 m. in length and 50 mm. in all smaller vessels.

(*g*) The requirements regarding ceiling over double bottom compartments in which oil fuel is carried are set forth in **Section 20, Sub-Section C, clause 2** (*c*).

2. **Cargo Battens in Cargo Spaces.**—(*a*) Cargo battens are to be fitted above the upper part of the bilge and in the 'tween decks of all types of vessels and in permanently enclosed spaces in bridges, poops, and other deck superstructures.

(*b*) Cargo battens should be 50 mm. in thickness, and the clear spacing between adjacent rows is not to exceed 230 mm.

(*c*) The cargo battens specified in the preceding paragraphs may be dispensed with at the request of the Owner. In such cases the certificate of classification will be endorsed "Cargo battens not fitted," and this notation will also be printed in the Register Book.

CEMENTING AND PAINTING.

Section 32. 1. **Cementing.**—(*a*) In single bottom vessels the frames and plating of the bottom to the upper parts of the bilges are to be efficiently covered with Portland or other approved cement, which may be mixed with sand or other material to form a suitable composition. Care is to be taken to have a proper thickness of cement at the edges, and to keep the watercourses clear all fore and aft.

(*b*) In double bottoms the frames and and shell plating are to be efficiently cemented in the tanks under the boiler room, except where these tanks are intended solely for the carriage of oil fuel. Elsewhere inside the double bottom cement may be dispensed with.

In all cases the plating at the bilges is to be efficiently cemented or coated with a suitable composition. If cement is used, it should not extend above the upper edges of the tank margin angle.

(*c*) Where asphalt, enamel cement, or similar compositions are to be used, the same is to be sanctioned by the Owners, and samples are to be submitted for the approval of the Committee.

(*d*) Before any covering is applied, care is to be taken to ensure that the plating is thoroughly clean, and, in addition, where asphalt, enamel cement, or similar compositions are used, that the surface is dry.

2. **Painting.**—(*a*) All steel and ironwork, not covered with cement, should receive at least two coats of paint of suitable composition. Previous to the painting, the surface of the steel and iron is to be thoroughly cleaned, and the painting of external steelwork should be delayed as long as possible.

(*b*) If desired by the Owners, cement washing may be adopted inside of double bottom tanks instead of painting.

STEERING GEAR.

Section 33. 1. **Steering Gear.**—(*a*) All vessels are to be fitted with two independent steering gears.

(*b*) In vessels exceeding 76 m. in length, one of the steering gears is to be operated by power.

(*c*) Hand gear of the right and left-handed screw and nut type is not to be fitted in vessels exceeding 91,5 m. in length.

(*d*) In all vessels an arrangement of blocks and tackle or other suitable alternative may be accepted as one of the two means for steering, provided it is fitted to the satisfaction of the Surveyor.

2. **Plans.**—In the case of rod and chain gear, complete plans of the main and auxiliary gears are to be submitted for approval showing clearly particulars and scantlings of the chains and rods, brake, sheaves, spring buffers, Warwick screws, shackles and other attachments, also the blocks, leads and tackle for the auxiliary gear.

3. **Scantlings.**—(*a*) The scantlings of tillers and quadrants are to be as given in **Table 45.** Quadrants and tillers are to be well shrunk on or bolted to the rudder head in addition to being secured by a key of suitable size. The area of the arms at ends may be one-third of the area given in the Tables, and where a quadrant tiller is not keyed to the rudder head, the area of the arms of the quadrant may be of these reduced dimensions throughout their length. Where cast steel tillers are fitted the scantlings are to be equivalent to those given in the Table.

(*b*) The diameters of the steering chains and rods, and the corresponding radii of quadrant tillers are given in **Table 45.** Where the radius of quadrant or length of tiller differs from that given in the Table, the diameter of the steering chain is to be suitably modified.

(*c*) All steering chains are to be subjected to the breaking and proof tests as set forth for short link cables in **Section 14** of the **Rules for the Quality and Testing of Materials.** These tests are to be carried out at a proving establishment recognised by the Committee, and the certificates are to be produced.

4. **Power of Engine.**—The power of the steering engine is to be such that the rudder can be put from hardover to hardover in 30 seconds while the vessel is going ahead at full sea speed.

5. **Spare Gear.**—A set of spares is to be provided consisting of one complete spring buffer and one extra spring, two tested chains each equal to the longest length in the gear, two Warwick screws, four shackles, four connecting links, and four rod-pins.

6. **Rudder Stops.**—Suitable stops for the rudder should be securely fastened to the deck in way of the tiller or quadrant tiller. The stops of the steering engine are to be fitted at a smaller angle of helm than the rudder stops.

7. **Locking or Brake Gear.**—An efficient locking or brake arrangement is to be fitted to keep the rudder steady when a change of gear is required.

8. **Protection of Steering Gear.**—In steamers above 76 m. in length, not having full poops, the after steering wheel and gear are to be protected by a substantially constructed steel house.

9. **Springs.**—Springs or buffers are to be fitted to all power operated steering gears.

10. **Leads of Steering Chains.**—(*a*) The leads of the steering chains are to be as direct as possible and sharp bends are to be avoided.

(*b*) The diameters of leading block sheaves, measured at the centre of the chain, are not to be less than sixteen times the diameter of the steering chains, and the pins of the sheaves are not to be less than twice the diameter of the chains.

PUMPING ARRANGEMENTS.

Section 34. 1. **General.**—In steam vessels the pumping arrangements according to the division of holds, rise of floor and other conditions are to be as follows, and plans of these arrangements are to be submitted for approval.

2. **Hold and Tank Drainage.**—(*a*) All steam vessels are to be provided with efficient pumping plant, having the suctions and means for drainage so arranged that any water which may enter any compartment of the ship, or any watertight section of any compartment, can be pumped out through at least one suction when the vessel is on an even keel, and is either upright or has a list of not more than five degrees. Wing suctions will not be required in narrow compartments at the ends of the vessel.

(*b*) In vessels having only one hold, and this over 35,5 m. in length, bilge suctions are to be fitted in suitable positions in the after half-length, also in the forward half-length, of the hold.

(*c*) Where close ceiling is fitted over the bilges, arrangements are to be made whereby water in a hold compartment may find its way to the suction pipes.

(*d*) Efficient means are to be provided for draining water from insulated chambers. (*See* **Section 3, clause 10, Rules for Refrigerating Machinery and Appliances.**)

(*e*) Where the inner bottom plating extends to the ship's side the bilge suctions may be placed either in a well the full width of the double bottom, or in wells placed at the wings and also at the centre line if the top plating has inverse camber.

The latter wells are to be formed of steel plates and the capacity of each well is not to be less than 0,17 cubic metres.

Steel bilge hats of reasonable capacity may be used where the spaces to be drained are of small dimensions.

(*f*) Where access manholes to bilge wells are necessary, they are to be fitted as near to the suction strums as practicable.

(*g*) Access to the bilge suction strum of a hold well should not be obtained by means of a manhole in the machinery space W.T. bulkheads, or tank top plating in the machinery space, if it be possible to avoid doing so.

Where, however, this arrangement is necessary, the manhole cover should be of hinged type and an instruction plate, in raised letters, should be affixed in a well-lighted position, to the effect that this door must be kept shut, except when access is required.

3. **Engine and Boiler Space Drainage.**—(*a*) Where the engine and boiler spaces are common and there is no double bottom, and the rise of floor is not less than 5°, one centre main bilge line and one independent power pump direct suction are to be fitted; but, if the rise of floor is less than 5°, additional main line bilge suctions are to be fitted at the wings.

(*b*) Where the engine and boiler spaces are common and the double bottom extends the full length of the space, forming bilges at the wings, two power pump suctions (one of which may be an independent power pump direct suction) are to be fitted to the bilge on each side. Where the inner bottom plating extends to the ship's side three main bilge line suctions and an independent power pump direct suction are to be fitted, either in a well the full width of the double bottom or in wells, placed at the wings and also at the centre line where the top plating has inverse camber.

(*c*) Where the main engine room(s), the boiler room(s) or the auxiliary engine room(s) are separated by W.T. bulkheads, the number and position of the main bilge line suctions are to be the same as in cargo holds.

In addition to the main bilge line suctions, an independent power pump direct bilge suction is to be fitted in each of the main and auxiliary engine rooms and boiler room(s).

(*d*) The main water circulating pumps are to be fitted with direct bilge suction connections, provided with non-return valves, to the lowest level in the machinery space and of a diameter at least two-thirds that of the sea inlet.

Where only one bilge injection is fitted, as in single screw vessels, this suction and the independent power pump direct bilge suction are to be fitted at opposite sides of the engine room, except in the case of a vessel having open floors in the machinery space and a rise of floor not less than 5°, when these suctions are to be fitted as near the centre line as practicable.

(*e*) The number of power driven bilge pumps is to be in accordance with the requirements of **Section 4** of the Engine and Boiler Rules: but, in lieu of the bilge pump direct suction to the engine room referred to in **clause 5** of that Section, a steam ejector suction of the same bore may be fitted.

4. **Fore and After Peak Drainage.**—(*a*) Where the peaks are fitted as water ballast tanks, a separate power pump suction is to be led to each. Where not used for water ballast and a main bilge line suction is not fitted, an efficient manual pump is to be fitted in the fore peak. Where the after peak is used as a ballast tank, no drain valve or drain cock is to be fitted to the bulkhead; but where not so used, it is to be drained by a manual pump or power pump suction, or by means of a self-closing cock in a readily accessible position. Where the flats above the peak tanks, or the chain locker are situated below the load water line, a manual pump or a power pump suction is to be provided.

(*b*) Where a suction pipe is led from the engine room through a hold space to the fore peak, it is to be provided with a screw-down valve capable of being operated from an accessible position above the load water line, the chest being secured to the collision bulkhead inside the fore peak.

5. **Tunnel Drainage.**—(*a*) The tunnel well is to be fitted with a power pump suction.

(*b*) Where the tank top in the tunnel slopes from aft to forward, a bilge suction is to be provided at the forward end of the tunnel, in addition to the tunnel well suction required by **paragraph** (*a*).

6. **Pipe System.**—(*a*) The arrangement of valves and their connections are to be such as to prevent the possibility of water passing from the sea or from water tanks into the cargo or machinery spaces, or from one compartment to another. To effect this requirement, the bilge connection

to any pump having also a suction from the sea should be made either by means of a non-return valve or a cock which cannot be open at the same time to the sea, or to water tanks and to the bilges. Valves in all bilge distribution boxes are to be of the non-return type.

Where connections are provided for bilge suction hoses, screw-down non-return valves are to be fitted at the branches to which the hoses are attached.

In the case of rotary pumps not having non-return valves incorporated in them, the direct bilge suctions are to be fitted with non-return valves.

(*b*) Cocks and valves connecting all bilge suction pipes are to be fixed in accessible places above the stokehold and engine room platforms.

(*c*) All pipes from the pumps which are required for draining cargo or machinery spaces are to be entirely distinct from pipes which may be used for filling or emptying spaces where water is carried.

(*d*) Bilge suction pipes are not to be carried through the double bottom tanks, if, as is generally the case, it is possible to avoid doing so. Bilge pipes where they pass through deep tanks and are subject to the full pressure due to the head of water in the tanks are to be of substantial strength and are to be tested, after fitting, to the same pressure as the tanks through which they pass.

(*e*) All suction and discharge pipes are to be efficiently secured in position and strapped to prevent lateral movement. The pipes are to be made in suitable lengths with flanged joints.

(*f*) Efficient expansion joints or bends are to be provided in each range of pipes and where the connections at bulkheads and other structural parts of the vessel are made with lead bends the radii of the bends and the distance between the axes of the straight parts of the pipe are each to be not less than three diameters, and the length of the bend is to be at least eight diameters of the pipe.

(*g*) The suctions in machinery spaces are to be led from easily accessible mud-boxes placed, whenever practicable, above the level of the working floor, with straight tail pipes to the bilges, and having covers secured in such a manner as to permit of them being expeditiously opened and closed. The suction ends in hold spaces are to be enclosed in strum-boxes having perforations not more than 10 mm. in diameter whose combined area is not less than twice that of the suction pipe, and the boxes are to be so constructed that they can be cleared without breaking any joint of the suction pipe. Suction pipes in tunnel wells are to have similar strum-boxes.

(*h*) Lead pipes are neither to be used within coal bunkers nor are they to be attached to bunker bulkheads, except in the case of steam fishing vessels, tugs, and tenders.

7. **Bilge Pumps.**—(*a*) Each power bilge pump is to be arranged to draw water from any hold or machinery compartment of the vessel, except where manual pumps only are permissible.

(*b*) Each power bilge pump required by **Section 4** of the **Rules for Engines and Boilers,** is to be capable of giving a speed of water through the pipes of the largest diameter required by the formula (**clause 9**) of not less than 122 m. per minute, under ordinary working conditions. Where, however, two bilge pumps are worked from the main engines, the capacity of each main engine bilge pump may be half that required above.

Alternatively, the capacity of the main engine bilge pumps may be less than that required above, provided the deficiency be made good by the independent power pump connected to the main bilge line.

(*c*) All power pumps which are essential for bilge service are to be of self-priming type.

(*d*) Manual pumps are at all times to be workable from a position above the load water line.

8. **Watertight Bulkhead Fittings.**—(*a*) No drain valve or drain cock is to be fitted to the collision bulkhead.

(*b*) No drain valves or drain cocks are to be fitted to the engine and boiler room bulkheads, or other watertight bulkheads, unless they are arranged so as to be accessible at all times and are so geared that they may be shut off from a position above the load water line.

(*c*) Where owners desire to fit non-return valves to bilge suction pipes in order to decrease the risk of flooding after damage, such valves are to be of an approved pattern.

(*d*) All other cocks and valves in connection with bilge and ballast suction pipes, unless otherwise specifically mentioned in the Rules, are to be fitted in places where they are at all times accessible.

(*e*) In the case of deep tanks which may be used for either water ballast or cargo, provision is to be made for blank flanging the water ballast filling and suction pipes when the tank is being used for cargo, and for blank flanging the bilge suction pipes when the tank is being used for water ballast.

(*f*) Valve chests, cocks, pipes, and other fittings attached to the bulkheads or to the tunnel plating are to be secured by means of studs screwed through the plate, or by tap bolts, and not by bolts passed through clearing holes.

9. **Diameters of Bilge Suction Pipes.**—(*a*) The inside diameters of bilge suction pipes, in mm., are to be in accordance with the following formulæ to the nearest 5 mm.

$$26 + \sqrt{2{,}78\ L\ (B + D)} \quad \ldots \quad \ldots \quad (1)$$

for main bilge line suctions and direct bilge suctions to the pumps, but in no case are these suctions to be less than the size required for the branch bilge suction to any one compartment.

$$26 + \sqrt{4{,}63\ C\ (B + D)} \quad \ldots \quad \ldots \quad (2)$$

for branch suctions to cargo and machinery spaces,

where L = length of vessel, in metres.
B = breadth of vessel, in metres.
D = moulded depth to bulkhead deck, in metres.
C = length of compartment, in metres.

(*b*) No main suction pipe is, however, to be less than 50 mm. in bore, and no branch pipe is to be less than 50 mm. in bore, or need be more than 100 mm. in bore.

(*c*) The area of each branch pipe connecting the bilge main to a bilge distribution chest is to be not less than the combined area of the two largest branch bilge suction pipes connected to that chest, but need not be greater than the size required for the bilge main suction pipe.

(*d*) Bilge suction pipes to fore and after peaks, and to the tunnel well, are to be not less than 55 mm. in bore, except in vessels not exceeding 61 m. in length, in which case they may be 50 mm. diameter.

10. **Air Pipes.**—(*a*) Air pipes are to be fitted at the outboard corners of the water ballast tanks at the opposite end of the tank to that at which the filling pipes are placed, or at the highest part of the tank.

(*b*) Air pipes are to be led to above the load water line.

(*c*) In the case of tanks which can be pumped up, the total cross sectional area of the air pipes is to be not less than that of the respective filling pipes.

(*d*) Where air pipes extend above the freeboard or superstructure decks, the height from the deck to the opening is to be at least 910 mm. in wells on freeboard decks, 760 mm. on raised quarter decks, and 460 mm. on other superstructure decks which are immediately above the freeboard deck.

11. **Sounding Pipes.**—(*a*) All water spaces and compartments, except the main engine and boiler compartments, are to be provided with straight open-ended sounding pipes, fitted as near as practicable to the pump suctions.

(*b*) Doubling plates, or their equivalent, are to be fitted under all sounding pipes for the rod to strike upon.

(*c*) Sounding pipes, including those for the double bottom below machinery spaces, should extend to positions, above the load water line, which are at all times accessible.

Where this arrangement is not practicable, short sounding pipes may be fitted, provided they be in readily accessible positions, and be furnished either with non-detachable screw caps, or with cocks having parallel plugs with permanently secured handles so loaded that, on being released, they automatically close the cocks.

(*d*) No sounding pipe is to be less than 32 mm. bore.

(*e*) In the case of insulated holds, sounding pipes, not less than 65 mm. bore, are to be provided both above and below the insulation.

These sounding pipes are to be efficiently insulated. (*See* **Section 3, clause 11, Rules for Refrigerating Machinery and Appliances.**)

(*f*) Where elbow sounding pipes are fitted, they are to be efficiently supported and of substantial thickness in order to withstand the use of the sounding rod.

12. **Protection of Pipes.**—All air and sounding pipes, suction and discharge pipes, and scupper and soil pipes are to be effectively protected where necessary against risk of damage from cargo or coal.

13. **'Tween deck Scupper Pipes.**—'Tween deck scupper pipes are to be fitted in accordance with the requirements of **Section 29, clause 2.**

14. **Vessels Fitted for Burning and Carrying Oil Fuel.**—The requirements of **Section 20** are also to be complied with.

15. **Sailing Vessels.**—The requirements for pumping in sailing vessels are set forth in **Section 35, clause 9.**

16. **Vessels employing Electric Propulsion.**—The requirements of **Section 5, clause 13, paragraph** (*b*) of the **Rules for Electric Propelling Machinery,** are to be complied with.

SAILING VESSELS.

Section 35. 1. **General.**—Sailing vessels are to be constructed in accordance with the rules and regulations for steamers, with the exceptions contained in the following clauses.

2. **Framing.**—(*a*) All reversed frames are to extend to the upper deck.

(*b*) Sailing vessels above 6,1 m., and not exceeding 10 m. moulded depth, are to have one tier of beams below the upper deck, spaced not more than two frame spaces apart, or equivalent transverse stiffening is to be provided.

(*c*) Sailing vessels above 6,1 m., and not exceeding 8,2 m. moulded depth, are to have a deep web frame, of the breadth and thickness of the second deck stringer plate, fitted in way of each mast, and connected to the outside plating with double angles. These web frames are to extend to the upper deck, and are to be provided with efficient lateral support.

(*d*) Where the moulded depth is above 8,2 m., and does not exceed 10 m., instead of the deep web frames prescribed in the preceding paragraph, partial bulkheads, with efficient lateral support, are to be fitted in way of each mast.

3. **Panting Arrangements.**—In addition to the panting arrangements required by **Section 7**, panting beams and stringers are to be fitted at the after end of the vessels where the moulded depth exceeds 4,5 m.

4. **Beams.**—Where the length of the midship beam does not exceed 9,15 m., the upper and second deck beams are to be 10 mm. deeper than given in **Tables 12** and **13** for upper deck beams of the same length in steamers where one tier of beams only is fitted; and where the length is above 9,15 m. the upper, second, and third deck beams are to be 20 mm. deeper than given in the Tables. The depths of the beam knees are to be correspondingly increased.

5. **Bulkheads.**—In sailing vessels only the foremost or collision bulkhead will be required, and it is to be placed at not less than one-tenth the vessel's length abaft the fore part of the stem.

6. **Decks.**—(*a*) In vessels which are not required to have complete steel decks, the decks in way of the masts are to be plated from side to side of the vessel.

(*b*) The thickness of wood decks is not to be less than 90 mm., and the margin planks of the weather deck are to be of either teak or greenheart.

7. **Bulwark Stanchions.**—The stanchions which support the bulwarks are not to be spaced more than 1,50 m. apart. Where stanchions are fitted on the butt straps of the bulwark plating, the straps are to be sufficiently broad to receive the spur in the middle of the stanchion, and the bulwark plating is to be doubled or fitted with vertical straps in way of the intermediate stanchions. The heel of each stanchion is to be attached by not less than four 22 mm. bolts. Their size may be from 35 mm. to 50 mm. in diameter, regulated by the length of the stanchion and the size of the vessel.

8. **Mast Rings.**—The mast rings are to be formed of bulb angle of suitable size.

9. **Pumps.**—Hand pumps are to be fitted in number and position as may be required for the efficient draining of the vessel. The pumps are to be capable of being worked from the upper deck or from above the load waterline, and the bottoms of the pump chambers are not to be more than 7,30 m. above the suction rose.

The sizes of the hand pumps are not to be less than given in the following Table :—

Tonnage under Upper Deck.	Hand Pumps.	
	Diameter of Barrel.	Diameter of Tail Pipe.
	Millimetres.	Millimetres.
Not exceeding 500 tons	100	50
Above 500 tons but not exceeding 1000 „	115	57
„ 1000 „ „ 2000 „	125	65
„ 2000 tons	140	70

10. **Equipment.**—(*a*) Where a sailing vessel has a poop, bridge, top-gallant-forecastle, or a raised quarter-deck, the equipment number is to be increased one-fifteenth above that for a flush-deck vessel.

(*b*) One of the bower anchors must have the weight required by the Tables, but otherwise the weights of bower anchors may be regulated in accordance with **Section 39, clause 4** (*a*).

11. **Strengthening of Bottom Forward.**—The requirements of **Section 11** of the Rules do not apply to Sailing Ships.

MASTS, SPARS AND RIGGING.

Section 36. Sailing Vessels. 1. Lower Masts. (*a*) The scantlings of lower masts are to be as given in **Table 49** and the length of the mast is to be measured from the deck to the hounds.

(*b*) The mizzen masts of barques may be reduced one-fifth in diameter from that given in the Table, and the thickness of the plating may be in accordance with the reduced diameter.

(*c*) The diameter of the lower mast at the cap is not to be less than that of the heel of the topmast, nor less than the greatest diameter of the lower topsail yard at centre.

(*d*) Where angle stiffeners are required these stiffeners are to be fitted for the full length of the masts.

(*e*) The butts of the plating are to be treble riveted above the mast partners; elsewhere they may be double riveted. The seams are to be double riveted throughout.

(*f*) Where pole masts are fitted, the length for determining the scantlings of the lower mast is to be taken from the deck to the hounds. In such masts additional strengthening is to be provided from below the lower yard to above the normal position of the lower mast cap.

(*g*) Doubling plates are to be fitted in way of the mast wedging and where masts are wedged at more than one deck, the doubling plates are to extend from below the lower to above the upper wedging.

(*h*) The heels of all masts and their steps are to be efficiently strengthened.

2. **Topmasts.**—(*a*) The length of the topmast is to be measured from the lower mast cap to the topmast hounds.

(*b*) The plating is to be of the thickness given in **Table 50.** The butts are to be treble riveted and the seams may be single riveted.

(*c*) The diameter of the topmasts at the lower cap, sheave hole and topmast cap is not to be less than that of the yards at these places.

(*d*) Doublings are to be fitted in way of the lower mast cap, in way of the fid holes and in way of the sheave holes where such are cut, and at the head.

(*e*) Efficient cheek plates are to be fitted to topmasts whose length exceeds 7,30 m.

3. **Topgallant Masts.**—The diameter of the topgallant mast is not to be less than the diameter of the topgallant yard.

4. **Yards.**—(*a*) The diameter of the yards and the thickness of the plating are to be in accordance with **Table 50.** The butts are to be double riveted and the seams single riveted.

(*b*) The plating is to be doubled in way of cleats and at the centre to beyond the truss hoops.

(*c*) Topsail and topgallant yards, where of pitch pine, are not to be less in diameter than 20 mm. per metre of length.

5. **Bowsprits.**—(*a*) The thickness of the plating is to be as given in **Table 49.**

(*b*) Doubling plates are to be fitted in way of the bowsprit wedging.

(*c*) Bowsprits exceeding 710 mm. in diameter are to have a vertical diaphragm plate extending from within the wedging to beyond the bobstay band, connecting the upper and lower parts of the bowsprit, and, in addition, two angle stiffeners of the size given in the Table are to be fitted. Bowsprits 710 mm. and under in diameter are to have angle stiffeners, extending the full length of the bowsprit, at the centre of each plate. The butts are to be double riveted and the seams single riveted.

6. **Steamers.**—(*a*) The length for determination of scantlings is to be measured from the deck to the hounds.

(*b*) The scantlings of the masts are to be in accordance with **Table 47,** and these scantlings are considered suitable for the support of average equipment of derricks of normal outreach provided the staying of the masts is efficient.

(*c*) Masts which are not intended to carry derricks may be 20 per cent less in diameter than required by **Table 47,** and the thickness of the masts may be in accordance with the reduced diameter.

(*d*) The butts of the plating are to be treble riveted above the mast partners, and the seams are to be single riveted.

(*e*) Doubling plates are to be fitted at the heel, at the wedging, in way of the derrick supports, and at the hounds. The length of these doublings is not to be less than the maximum diameter of the mast.

7. **Rigging.**—(*a*) The shrouds and stays for steamers and sailing ships are to be in number and size as required by **Tables 48** and **51,** and they are to withstand the tests specified.

(*b*) Chain plates are to be securely connected to the structure of the vessel which is to be efficiently stiffened for this purpose where necessary.

(*c*) All smith work for masts, spars and rigging is to be of the best description of wrought iron, and particular attention is to be paid to workmanship.

8. **Lightning Conductors.**—Lightning conductors are to be fitted in accordance with the requirements of **Section 14** of the **Rules for Electrical Equipment.**

TUGS.*

Section 37. 1. **General.**—The scantlings and arrangements of Tugs for which the Class 100A1 "For Towing Services" is desired, are to be as required by the Rules and Tables, except where specified otherwise in this Section.

*NOTE.—**Trawlers.**—*The Society's requirements regarding the Construction and Classification of Steel Trawlers are published separately.*

2. **Floors.**—(*a*) The floors, if desired, may be flanged 90 mm. on the upper edge, in lieu of reversed bars, except in the engine room and under boiler bearers.

(*b*) Where the bottom of the vessel is filled solid with cement to the level of the top of the floors, the fitting of reversed frames, or the flanging of the floors, may be dispensed with.

3. **Keelsons.**—The scantlings of the keelsons are to be in accordance with the requirements of **Table 11.**

4. **Bulkheads.**—The scantlings of the bulkhead stiffeners and plating are to be in accordance with the requirements of **Tables 29** and **31.** Bracket or lug attachments need not be fitted at the ends of the stiffeners.

5. **Decks.**—The deck is to be completely plated over abreast the machinery openings.

6. **Machinery Casings.**—(*a*) The machinery casings are not to be less in height than 910 mm. above the top of the deck, and are to extend to the underside of the deck beams. The casings are to be connected to the deck plating with angle bars, and to the ends of the half beams with angle lugs. If the casings are not extended to the underside of the beams, they are to be attached to the deck plating by a double riveted angle bar, or the deck plating may be turned up the casing side and double riveted thereto.

(*b*) Machinery casings are to be hose tested on completion to ensure watertightness.

(*c*) A strong through beam is to be fitted at the deck level at the middle of the length of the machinery opening, and, if practicable, should be associated with webs on the sides of the casing.

7. **Hatchways.**—Hatch coamings are not to be less than 300 mm. in height, and the covers and battening arrangements are to comply with the requirements of **Section 25.**

8. **Rudders.**—The diameter of the rudder head is to be increased 15 mm. beyond that required by **Table 41,** and all the scantlings of the rudder are to be in accordance with the increased diameter.

9. **Equipment.**—The equipment for Tugs is to be as given in **Table 55.** The equipment to be supplied to vessels of this type is to be regulated by the second longitudinal numeral $L \times (B + D)$, without any addition for casings or other erections.

10. **General.**—The requirements of **Section 7** and **Section 11** do not apply to Tugs.

WORKMANSHIP.

Section 38. 1. **General.**—The workmanship is to be well executed and submitted to the closest inspection.

2. **Treatment of Material.**—(*a*) Cementing or painting is to be delayed as long as possible so that the removal of the black oxide or mill scale may be facilitated.

(*b*) Experience has shown that, as regards durability, it is highly desirable to place steel vessels in dry dock within a reasonably short period after being launched for the purpose of cleaning and re-coating the bottom.

3. **Riveting.**—(*a*) Rivet holes are to be regularly spaced and are to be carefully punched from the faying surfaces wherever possible.

(*b*) Rivet holes are to be properly formed and the burr caused by punching removed before the parts are fitted together for riveting.

(*c*) The rivet holes at the turn of the bilge in frames are not to be punched until the frames are bent to the required shape.

(*d*) Before riveting is commenced the work is to be carefully closed with nut and screw bolts, which are to be spaced sufficiently close to draw the parts together effectively.

(*e*) Unfair holes are to be properly rimered and re-countersunk if necessary and are not to be cut with a chisel or unduly drifted.

(*f*) The rivets are to be staved up so as to fill the holes completely, and their heads are to be properly laid up. The points are to be left full, but are not to be spread over the plating.

(*g*) The punches and dies are to be maintained in satisfactory condition.

4. **Joggling and Lining Pieces.**—(*a*) Where plates or bars are joggled, care is to be taken to ensure that the depth of joggle is the same as the thickness of the adjacent plating.

(*b*) Where lining pieces are fitted they are to be in one piece and are to be of the same breadth as the flange of the frames.

5. **Caulking.**—Caulking is to be carefully and thoroughly executed.

EQUIPMENT.

Section 39. 1. **Notation.**—The figure 1 placed after the character assigned to a vessel indicates that the equipment is considered to be suitable and is in good and efficient condition.

2. **Equipment Number.**—The equipment of anchors, chains, hawsers, and so forth, is to be regulated by the second numeral L × (B + D) to which an allowance for superstructures is to be added as follows:—

(*a*) For a raised quarter-deck the product of the height and length in metres.

(*b*) For a poop, bridge, or forecastle, three-fourths the product of the height and length in metres.

(*c*) For deckhouses or other erections which do not extend to the side of the vessel but which exceed, either in length or breadth, one-half the breadth of the vessel, one-half the product of the height and length in metres.

3. **Testing of Equipment.**—(*a*) All anchors and cables are to be tested at a public machine recognised by the Committee and in accordance with the requirements of **Sections 11, 12** and **13** of the **Rules for the Testing of Materials.**

(*b*) In the case of vessels whose anchors and chains have been tested at one of the recognised Proving Establishments in Great Britain and Ireland, the notation "Lloyd's A&CP" will be made in the Register Book.

(*c*) In the case of vessels of other than British Registry classed with the figure 1, in which the anchors, chains, or both, have been tested under the inspection of the Society's Surveyors at Proving Establishments out of Great Britain and Ireland recognised by the Committee, and test certificates are furnished, duly signed by the Society's Surveyors, the vessel will have recorded in the Register Book the notation "Lloyd's A&CP," "Lloyd's AP," or "Lloyd's CP," as the case may be.

(*d*) Where, however, the anchors or chains for vessels of other than British Registry are manufactured out of Great Britain and Ireland, and test certificates are furnished setting forth that they have been tested at a Government machine, or at a machine under the control of a municipal body or a similar responsible body, but not under the inspection of a Surveyor to the Society, the record of Lloyd's A&CP, and so forth, will not be made in the Register Book, though such certificates will be accepted as satisfying the requirements of the Rules as regards tests in assigning the figure 1.

(*e*) Certificates stating that all anchors and chains have been tested, and giving particulars of the loads applied, are to be produced before the ship is classed with the figure 1.

4. **Equipment.**—(*a*) All vessels classed 100A1, or 100A1 "with freeboard," are to be provided with anchors, cables, and hawsers, in number, weight and length as set forth in **Tables 53** and **54**. Provided the collective weight of the bower anchors is not less than required by the Tables, then:—

(1) The bower anchors may be of equal weight; or

(2) Where three bower anchors are required, one of them may be 15 per cent and another 7,5 per cent lighter than the weight required by the Tables; or

(3) Where only two bower anchors are required, one of them may be 7,5 per cent lighter than the weight required by the Tables.

The weights of cables include two end shackles to each cable (*i.e.*, four end shackles for each outfit which contains two cables), and two end shackles to each stream chain.

(*b*) In the case of vessels classed A "For Special Services," the equipment is to be as required by the Committee, having in view the particular trade in which the vessel is to be engaged.

(*c*) To entitle vessels classed A "For Channel Purposes" to the figure 1, the equipment of anchors, chains, and so forth, is to be as required by **Table 53**, except that not more than two bower anchors and one steam anchor need be supplied. The first bower anchor is to be of the full weight required by the Table and the second bower may be 15 per cent lighter. This rule, however, applies only to vessels intended for short voyages.

(*d*) In vessels classed "For Channel Purposes," which are intended for longer voyages, such as the Queenboro-Flushing, the Channel Islands or the Irish Sea service, the equipment is to be in accordance with the requirements of the Tables.

(*e*) The equipment for Tugs is to be as given in **Table 55**, the equipment numeral being computed as described in **Section 37, clause 9.**

5. **Anchors and Chains.**—(*a*) The anchors and the links of the chain are not to be of exceptionable form or proportions.

(*b*) All anchor stocks are to be of acknowledged and approved description and equal to one-fourth the specified weight of the anchor.

(*c*) The heads of stockless anchors are to be not less than three-fifths of the total weight of the anchor.

6. **Renewal of Chain Cable when worn.**—When any length of chain cable is so worn that the mean diameter at its most worn part is reduced to the size given in **Table 56** it is to be renewed.

7. **Windlass and Hawsepipes.**—(*a*) A substantial windlass is to be fitted of suitable size for the cable, and is to be efficiently secured. Stiffening under windlass is to be provided as required by **Sections 15** and **16.**

(*b*) Hawsepipes are to be of sufficient size and thickness, and the arrangements such as to admit of an easy lead for the cable to the windlass or capstan.

8. **Boats.**—All vessels not exceeding 150 tons are to be provided with one good boat, and every vessel above 150 tons is to have a suitable number of boats.

The Surveyors are to examine and to report on the condition of the boats.

9. **Anchor Cranes and Boat Davits.**—(*a*) The sizes of the principal parts of anchor cranes are to be in accordance with **Table 52,** and the outreach of the cranes is to be sufficient to swing the anchors well clear.

(*b*) In the cases of boats and davits of ordinary proportions the diameter *d*, in millimetres, of the davit is to be obtained by using the formula :—

$$d = 124 \sqrt[3]{\frac{L \times B \times D\,(H + 4S)}{C}}$$

where L, B and D are the length, breadth and depth respectively of the boat, H is the height of the davit above its uppermost point of support, and S is the outreach of the davit; each of these distances being in metres.

The value of the constant C is to be as follows :—

(1) When the davit is to be of wrought iron and of sufficient strength to carry the boat and its equipment, and a sufficient number of men to launch it, the value of C is to be 144.

(2) When the davit referred to in (1) is to be of wrought ingot steel from 42,5 to 50 kg. per mm². tensile strength, the value of C is to be 174.

(3) When the davit is to be of wrought iron and of sufficient strength to lower safely the boat fully equipped and carrying the maximum number of persons for which it is intended, the value of C is to be 86.

(4) When the davit referred to in (3) is to be of wrought ingot steel of from 42,5 to 50 kg. per mm². tensile strength, the value of C is to be 104.

(*c*) Boat and anchor davits may be approved of weldless rolled or drawn steel tubes of the equivalent sizes given in **Table 52,** provided the steel of which the davits are made has a tensile strength of not less than 55 kg. per mm²· with an elongation of not less than 10 per cent in a length of 200 mm.

(*d*) The davits are to have solid heels and are to be efficiently strengthened in way of the heads and deck supports.

10. **Notation Withdrawn.**—Where the equipment is not in accordance with the requirements of the Rules, a dash thus –, will be inserted in place of the figure 1. In cases where the figure 1 is expunged on account of deficiencies in the anchors or chains, the record of Lloyd's A&CP will also be expunged.

STRENGTHENING FOR ICE NAVIGATION

Section 40. 1. **Framing**:—(*a*) Forward of the collision bulkhead, intermediate frames are to be fitted extending from below the level of the floors to the deck next above the load waterline, with scantlings as required by **Tables 2** or **3** for angle frames in peaks, but with thickness 2,5 mm. greater.

(*b*) Abaft the collision bulkhead all the main frames for a distance from the stem equal to 15 per cent of the length of the vessel are to be in accordance with the requirements of **Section 7, clause 2,** and as required for Complete Superstructure Vessels in **Table 5.** The attachments at the ends of these frames are to be as required by **Section 7, clause 2.**

Intermediate frames of scantlings required by **Table 4** for bulb angle frames in peaks are to be fitted extending aft from the stem for a distance equal to 20 per cent of the length of the vessel where the length does not exceed 61 m., graded to 15 per cent of the length of the vessel, where the length is 122 m. and above.

These intermediate frames are to extend either from the margin plate, or in single bottom vessels from below the tops of the floors, to the deck next above the load water line; they need not be connected at their ends.

In Full Scantling Vessels, however, the strength and stiffness of the side framing are not to be less than required by **Section 7, clause 2B** of the Rules.

(*c*) The intermediate frames required above may be dispensed with provided the frame spacing is reduced to 455 mm. and the scantlings of the side framing are made equivalent in strength and stiffness. This reduced frame spacing is to extend aft for the distance prescribed in **paragraph** (*b*).

EQUIPMENT.

Section 39. 1. **Notation.**—The figure 1 placed after the character assigned to a vessel indicates that the equipment is considered to be suitable and is in good and efficient condition.

2. **Equipment Number.**—The equipment of anchors, chains, hawsers, and so forth, is to be regulated by the second numeral L × (B + D) to which an allowance for superstructures is to be added as follows:—

(*a*) For a raised quarter-deck the product of the height and length in metres.

(*b*) For a poop, bridge, or forecastle, three-fourths the product of the height and length in metres.

(*c*) For deckhouses or other erections which do not extend to the side of the vessel but which exceed, either in length or breadth, one-half the breadth of the vessel, one-half the product of the height and length in metres.

3. **Testing of Equipment.**—(*a*) All anchors and cables are to be tested at a public machine recognised by the Committee and in accordance with the requirements of **Sections 11, 12** and **13** of the **Rules for the Testing of Materials.**

(*b*) In the case of vessels whose anchors and chains have been tested at one of the recognised Proving Establishments in Great Britain and Ireland, the notation "Lloyd's A&CP" will be made in the Register Book.

(*c*) In the case of vessels of other than British Registry classed with the figure 1, in which the anchors, chains, or both, have been tested under the inspection of the Society's Surveyors at Proving Establishments out of Great Britain and Ireland recognised by the Committee, and test certificates are furnished, duly signed by the Society's Surveyors, the vessel will have recorded in the Register Book the notation "Lloyd's A&CP," "Lloyd's AP," or "Lloyd's CP," as the case may be.

(*d*) Where, however, the anchors or chains for vessels of other than British Registry are manufactured out of Great Britain and Ireland, and test certificates are furnished setting forth that they have been tested at a Government machine, or at a machine under the control of a municipal body or a similar responsible body, but not under the inspection of a Surveyor to the Society, the record of Lloyd's A&CP, and so forth, will not be made in the Register Book, though such certificates will be accepted as satisfying the requirements of the Rules as regards tests in assigning the figure 1.

(*e*) Certificates stating that all anchors and chains have been tested, and giving particulars of the loads applied, are to be produced before the ship is classed with the figure 1.

4. **Equipment.**—(*a*) All vessels classed 100A1, or 100A1 "with freeboard," are to be provided with anchors, cables, and hawsers, in number, weight and length as set forth in **Tables 53** and **54**. Provided the collective weight of the bower anchors is not less than required by the Tables, then:—

(1) The bower anchors may be of equal weight; or

(2) Where three bower anchors are required, one of them may be 15 per cent and another 7,5 per cent lighter than the weight required by the Tables; or

(3) Where only two bower anchors are required, one of them may be 7,5 per cent lighter than the weight required by the Tables.

The weights of cables include two end shackles to each cable (*i.e.*, four end shackles for each outfit which contains two cables), and two end shackles to each stream chain.

(*b*) In the case of vessels classed A "For Special Services," the equipment is to be as required by the Committee, having in view the particular trade in which the vessel is to be engaged.

(*c*) To entitle vessels classed A "For Channel Purposes" to the figure 1, the equipment of anchors, chains, and so forth, is to be as required by **Table 53**, except that not more than two bower anchors and one steam anchor need be supplied. The first bower anchor is to be of the full weight required by the Table and the second bower may be 15 per cent lighter. This rule, however, applies only to vessels intended for short voyages.

(*d*) In vessels classed "For Channel Purposes," which are intended for longer voyages, such as the Queenboro-Flushing, the Channel Islands or the Irish Sea service, the equipment is to be in accordance with the requirements of the Tables.

(*e*) The equipment for Tugs is to be as given in **Table 55**, the equipment numeral being computed as described in **Section 37, clause 9.**

5. **Anchors and Chains.**—(*a*) The anchors and the links of the chain are not to be of exceptionable form or proportions.

(*b*) All anchor stocks are to be of acknowledged and approved description and equal to one-fourth the specified weight of the anchor.

(*c*) The heads of stockless anchors are to be not less than three-fifths of the total weight of the anchor.

6. **Renewal of Chain Cable when worn.**—When any length of chain cable is so worn that the mean diameter at its most worn part is reduced to the size given in **Table 56** it is to be renewed.

7. **Windlass and Hawsepipes.**—(*a*) A substantial windlass is to be fitted of suitable size for the cable, and is to be efficiently secured. Stiffening under windlass is to be provided as required by **Sections 15** and **16.**

(*b*) Hawsepipes are to be of sufficient size and thickness, and the arrangements such as to admit of an easy lead for the cable to the windlass or capstan.

8. **Boats.**—All vessels not exceeding 150 tons are to be provided with one good boat, and every vessel above 150 tons is to have a suitable number of boats.

The Surveyors are to examine and to report on the condition of the boats.

9. **Anchor Cranes and Boat Davits.**—(*a*) The sizes of the principal parts of anchor cranes are to be in accordance with **Table 52,** and the outreach of the cranes is to be sufficient to swing the anchors well clear.

(*b*) In the cases of boats and davits of ordinary proportions the diameter *d*, in millimetres, of the davit is to be obtained by using the formula :—

$$d = 124 \sqrt[3]{\frac{L \times B \times D\,(H + 4S)}{C}}$$

where L, B and D are the length, breadth and depth respectively of the boat, H is the height of the davit above its uppermost point of support, and S is the outreach of the davit; each of these distances being in metres.

The value of the constant C is to be as follows :—

(1) When the davit is to be of wrought iron and of sufficient strength to carry the boat and its equipment, and a sufficient number of men to launch it, the value of C is to be 144.

(2) When the davit referred to in (1) is to be of wrought ingot steel from 42,5 to 50 kg. per mm². tensile strength, the value of C is to be 174.

(3) When the davit is to be of wrought iron and of sufficient strength to lower safely the boat fully equipped and carrying the maximum number of persons for which it is intended, the value of C is to be 86.

(4) When the davit referred to in (3) is to be of wrought ingot steel of from 42,5 to 50 kg. per mm². tensile strength, the value of C is to be 104.

(*c*) Boat and anchor davits may be approved of weldless rolled or drawn steel tubes of the equivalent sizes given in **Table 52,** provided the steel of which the davits are made has a tensile strength of not less than 55 kg. per mm²· with an elongation of not less than 10 per cent in a length of 200 mm.

(*d*) The davits are to have solid heels and are to be efficiently strengthened in way of the heads and deck supports.

10. **Notation Withdrawn.**—Where the equipment is not in accordance with the requirements of the Rules, a dash thus –, will be inserted in place of the figure 1. In cases where the figure 1 is expunged on account of deficiencies in the anchors or chains, the record of Lloyd's A&CP will also be expunged.

STRENGTHENING FOR ICE NAVIGATION

Section 40. 1. **Framing**:—(*a*) Forward of the collision bulkhead, intermediate frames are to be fitted extending from below the level of the floors to the deck next above the load waterline, with scantlings as required by **Tables 2** or **3** for angle frames in peaks, but with thickness 2,5 mm. greater.

(*b*) Abaft the collision bulkhead all the main frames for a distance from the stem equal to 15 per cent of the length of the vessel are to be in accordance with the requirements of **Section 7, clause 2,** and as required for Complete Superstructure Vessels in **Table 5.** The attachments at the ends of these frames are to be as required by **Section 7, clause 2.**

Intermediate frames of scantlings required by **Table 4** for bulb angle frames in peaks are to be fitted extending aft from the stem for a distance equal to 20 per cent of the length of the vessel where the length does not exceed 61 m., graded to 15 per cent of the length of the vessel, where the length is 122 m. and above.

These intermediate frames are to extend either from the margin plate, or in single bottom vessels from below the tops of the floors, to the deck next above the load water line; they need not be connected at their ends.

In Full Scantling Vessels, however, the strength and stiffness of the side framing are not to be less than required by **Section 7, clause 2B** of the Rules.

(*c*) The intermediate frames required above may be dispensed with provided the frame spacing is reduced to 455 mm. and the scantlings of the side framing are made equivalent in strength and stiffness. This reduced frame spacing is to extend aft for the distance prescribed in **paragraph** (*b*).

(*d*) The breadth of the shell flange of the frames is to be suitable for the increased thickness of shell plating required by this Section.

2. **Shell Plating.**—(*a*) From 0,3 m. above the load line to 1,2 m. below the light line, and in a fore and aft direction from the stem to a point at least as far aft as the extent of the reinforced framing, the shell plating is to be fitted of a thickness equal to that required by **Table 18** of the Rules for side shell plating amidships increased by 40 per cent if intermediate frames are fitted, or by 55 per cent if a frame spacing of 455 mm. is adopted ; the increased thickness of shell plating need not exceed 25 mm. The shell plate in each strake immediately abaft this point is to be intermediate in thickness between the full amount required for ice strengthening under this clause and the normal thickness of side shell plating.

(*b*) Seams of shell plating from 0,3 m. above the load line to 1,2 m. below the light line are to be at least double riveted for a distance aft of the stem equal to 25 per cent of the vessel's length, where the length does not exceed 61 m., graded to 15 per cent of the length of the vessel where the length is 122 m. and above.

3. **Stringers.**—Side stringers are to be fitted forward and aft of the collision bulkhead in accordance with the requirements of **Section 7** of the Rules. These stringers are to be carried aft to the normal thickness of side plating.

4. **Rudder and Steering Arrangements.**—The diameter of the rudder head is to be increased 15 per cent above the Rule requirements where the Rule diameter is less than 200 mm., and by 10 per cent where the Rule diameter is 200 mm. or above. The scantlings of the rudder, rudder quadrant and tiller, and the diameter of the steering chains and rods are to be in accordance with the increased diameter of rudder head.

5. **Screw Shaft.**—The diameter of the screw shaft is to be increased 5 per cent above that required by the Rules.

6. **Propeller Blades.**—The propeller blades are to be made of cast steel, or other approved material.

Where bronze is used for propellers or propeller blades, it is to comply with the requirements of **Section 11** of the **Rules for Quality and Testing of Materials.**

7. **Ship Side Valves.**—Sea inlet valves and overboard discharge valves below the maximum load water line are to be provided with connections from the boiler, or air receiver where no boiler is fitted, for clearing purposes.

The scantlings of the valves are to be suitable for the maximum pressure to which they will be subjected.

8. **Plans to be Submitted.**—Where it is desired that a vessel should receive the notation for ice strengthening (*see* par. (*g*), page 9), plans showing the proposed arrangements should be submitted for the approval of the Committee.

71, Fenchurch Street, London, E.C.3.
8th April, 1937.

GENERAL.

Section 41. 1. **Equivalents.**—Any arrangement or fitting which, in the opinion of the Committee, is in all respects as efficient as that required by the Rules may be accepted instead of such arrangement or fitting.

The Owners' consent to the adoption of any proposed equivalent is to be obtained where considered necessary by the Committee.

2. **Interpolation.**—For numerals and dimensions intermediate between those given in the Tables, scantlings are to be obtained by proportional interpolation.

For a particular numeral the Table gives the minimum requirements and where a numeral is in excess of a Table numeral, the scantling to be taken is to be the nearest practicable above the requirements for the Table numeral.

3. **Gradual Reductions.**—(*a*) Where scantlings are required to be adopted over a proportion of the vessel's length, any reductions which may be permitted toward the ends of the vessel are to be effected gradually.

(*b*) Care is to be taken as far as possible to avoid any abrupt changes or discontinuities in the form of the structure, and where such occur suitable structural compensation is to be provided.

4. **Buttstraps to Continuous Longitudinal Angles.**—Buttstraps need not be fitted to continuous longitudinal angles which serve simply as connecting bars, except in the case of the stringer bars on strength decks.

5. **Items not Particularly specified.**—Where special reference is not made in the Rules to specific requirements, the construction is to be reasonably efficient for the intended service, and is to conform to good average practice.

By order of the Committee,
MALCOLM K. SCOTT,
Secretary.

RULES FOR THE APPLICATION OF ELECTRIC ARC WELDING TO SHIP CONSTRUCTION.

GENERAL.

Section 1. 1. Electrodes are to be approved by the Committee, and are to comply with the Regulations and Tests set forth in **Section 4.**

2. For parts of a ship such as inner bottoms, lower decks, bulkheads, internal work in tanks, casings and deck-houses, and other parts of similar structural importance, the electrodes are to comply with the Regulations and Tests set forth in **Section 4, clauses 1** to **6.**

3. When electric welding is proposed for parts of the structure which are of primary importance, the electrodes are also to be subjected to the additional tests set forth in **Section 4, clause 7.**

4. When electric welding is applied to parts of the structure such as those referred to in **clauses 2** and **3,** the consent of the owners is to be obtained, and a suitable notation will be made in the Register Book.

5. In the case of non-structural items only, as, for example, the attachment of various fittings to bulkheads, etc., the electrodes need not comply with the Regulations and Tests contained in **Section 4,** but the work is to be done to the satisfaction of the surveyor.

WORKMANSHIP.

Section 2. 1. The surveyors are to be satisfied that the operators are specially trained and are experienced and efficient in the use of the welding system proposed to be employed, and that an effective degree of supervision has been provided.

2. The amperage of the current is to conform, as far as practicable, to that determined by the makers of the electrode and as used for the tests on which approval of the electrode was given.

3. Before welding, the surfaces are to be fitted closely to each other and means provided for maintaining them in this position during the operation. Where the webs of girders are attached to plating by welding, a close fit is to be maintained.

4. All surfaces to be welded are to be clean and free from rust and paint. Where successive runs of welding are employed, the surface of each layer is to be thoroughly cleaned and free from slag before the application of the next.

5. As far as practicable, welding is to be done under cover, and is not to be proceeded with in exposed conditions during wet or frosty weather.

6. The design is to be such that, so far as possible, the necessity for overhead welding is avoided, and the progressive execution of the work should be such as to reduce to a minimum stress due to distortion.

DETAILS OF CONSTRUCTION.

Section 3. 1. Details of the construction and of the welds, including particulars of the size and type of electrode proposed to be used, are to be submitted for approval.

2. At butt welds the edges of the plates are to be veed to an angle of normally 60 degrees, leaving a gap at the bottom of the vee. The breadth of the gap is not to be greater than 3 mm. where the thickness of the plate is 12,5 mm. or above, and 1,5 mm. for plates of lesser thickness.

3. The breadths of overlaps of butts and seams are to be sufficient to enable the plates to be brought together, but are not to be less than given in the following table, which also gives the thickness of the weld at the throat:—

Thickness of plate. mm.	Width of overlap mm.		Throat thickness. mm.
	Seam.	Butt.	
10 ...	40	55 ...	7
15 ...	45	65 ...	10
20 ...	50	70 ...	12,5
25 ...	65	75 ...	15

Intermediate values may be obtained by direct interpolation, and for thicknesses below 10 mm. the throat thickness is to be about 70 per cent of the thickness of the plate.

4. Frames, beams, bulkhead stiffeners and similar sectional material need not have faying flanges. Where necessary, compensation is to be provided so that the support to the plating shall be equivalent to the requirements of the Rules.

5. A "full weld" extends from the edge of a plate for a distance equal to the thickness of the plate to be attached, and the dimension of the weld at the throat is given in the above table.

6. A "light closing weld" is a single run of light welding worked continuously along the edge of the plate.

7. "Intermittent" welding consists of a series of short welds each 75 mm. in length and having the same section as a full weld. These welds are to be arranged on alternate sides. Intermittent welds are to be spaced $2\frac{1}{2}$ times the length of the weld from centre to centre where the diameter of the rivets required by the Rules does not exceed 19 mm., or where the spacing of these rivets is less than 7 diameters. Where the Rule diameter of rivets exceeds 19 mm., or where the spacing is 7 diameters, the spacing of the welds may be 3 times the length of the weld. At the extreme ends of stiffeners and girders the welds are to be opposite each other.

8. The general character of welds is to be in accordance with the following table :—

	Inside edge.	Outside edge.
Overlap butts of shell plating, deck plating, and centre girder	F.	F.
Seams of shell plating and deck plating, and overlap butts and edges of inner bottom plating and of bulkhead plating	L.	F.
Connection of frames to shell plating, reverse frames to frame and floors, beams to deck plating, floors and intercostals in double bottoms, bulkhead stiffeners	I.	

F. = full weld. L. = light weld. I. = intermittent weld.

9. All bars required to be watertight are to have continuous welding on both flanges with tack welding at heel of bar.

10. Where considered necessary, or where additional riveting is required by the Rules, the Committee may require attachments to be increased beyond those specified above.

REGULATIONS AND TESTS FOR ELECTRODES FOR WHICH THE APPROVAL OF THE COMMITTEE IS DESIRED.

Section 4. 1. The manufacturers' plant and method of production of the electrodes are to be such as to ensure a reasonable uniformity in manufacture.

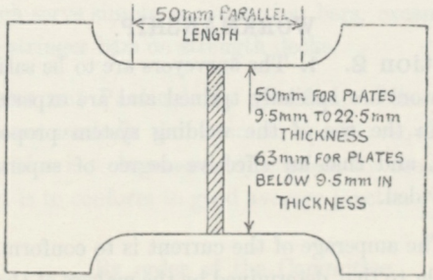
2. Each carton or package is to contain a certificate from the manufacturer on the following lines :—

> "The . . . . Company certifies that the composition and quality of these electrodes conform with those of the electrodes used in making the test pieces submitted to and approved by the Committee of Lloyd's Register of Shipping."

3. All test pieces must be prepared under ordinary working conditions in the shipyard, by the yard operators, using the yard plant. This must be done in the presence of a representative of the Society, and all tests must be carried out under his supervision.

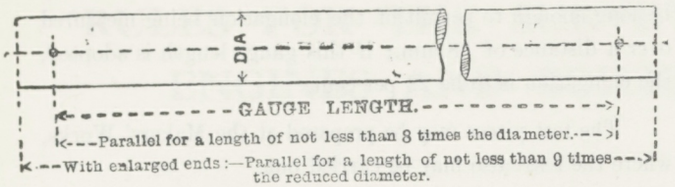
4. The steel used in the preparation of the specimens is to be ship steel having a tensile strength of from 41 to 50 kgs. per mm^2.

5. **Tensile Tests.**—Two sets of tensile test pieces with butt joints are to be prepared, each set consisting of specimens of different thickness. The minimum thickness of plate to be used is the maximum which would normally be welded with square edges. The other thicknesses of plate are to be 9,5, 16 and 22,5 mm. Each test piece is to be 50 mm. in parallel length in way of the weld, 50 mm. in width for plates 9,5 to 23,5 mm. in thickness and 63 mm. in width for plates below 9,5 in thickness, in accordance with the following sketch. The surfaces of the welded joints are to be machined so that the thickness of the specimen in way of the weld is not greater than that of the plain plate.



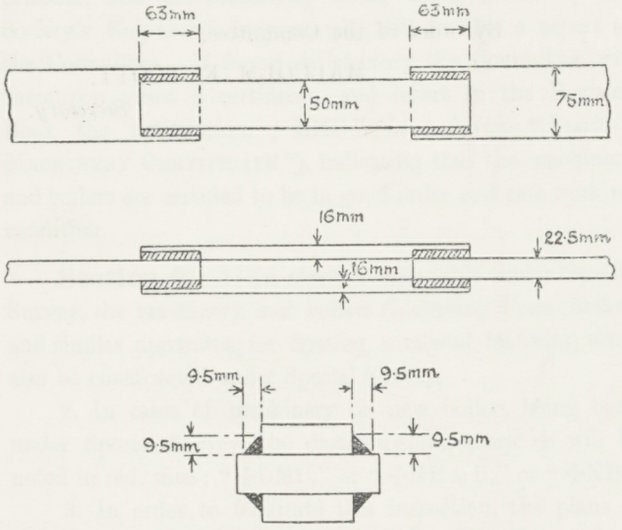
The mean tensile strength of the test pieces for each thickness is not to be less than 41 kgs. per mm^2.

Two specimens of deposited material are to be prepared and machined to the form of the test piece in the following sketch.



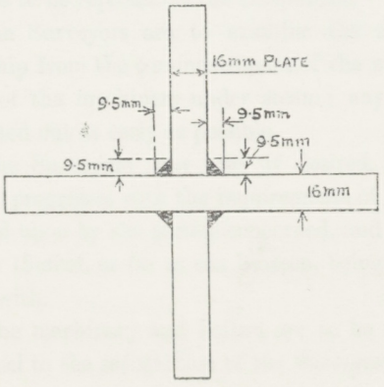
The sectional area of the test piece is not to be less than 160 mm. The tensile breaking strength is not to be less than 41 kgs. per mm^2.

6. **Shear Test.**—Two test pieces are to be prepared in accordance with the following sketch, the centre plates being 75 mm. in breadth and the outer plates 50 mm. in breadth.



The shear strength of the welds is not to be less than 180 kgs. per linear millimetre.

7. **Fillet Weld Tests.**—Two test pieces are to be prepared from plate 16 mm. in thickness and 50 mm. in width, in accordance with the following sketch.



The test pieces are to withstand, without fracture of the welds, a test load of 290 × t kgs., t being the average throat thickness of the weld in millimetres.

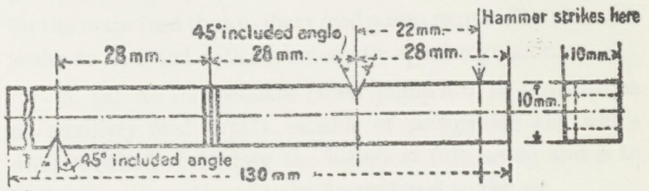
8. A chemical analysis of the metal of each type of electrode and of the deposited material of a weld made by the same electrode, together with specimens of the finished electrode, are to be supplied for purposes of record. The Committee should be notified of any alteration subsequently proposed to be made in the process of manufacture.

9. **Additional Tests for Electrodes proposed to be used for parts of Primary Structural Importance.**

Ductility.—The material deposited by the electrode and tested as described in **clause 5** is to show an elongation of not less than 18 per cent.

Bend Test.—A sample of the deposited material is to be capable of being bent without fracture through an angle of 120 degrees over a bar having a diameter equal to twice the thickness or diameter of the test piece, the sectional area of the test piece being not less than 160 mm^2.

Impact Test.—Two specimens consisting of deposited material, each not less than 130 mm. in length and machined to 10 mm. square in section, are to be submitted to impact test by the Izod or other approved method. Three notches, the first 28 mm. from one end and the others 28 mm. apart, are to be arranged mutually at right angles, as shown below:—



THREE NOTCH TEST PIECE.

The depth of the notch is to be 2 mm., the included angle 45 degrees, and the radius at the root ·25 mm.

The average value for each specimen is to be not less than 4·2 kilogrammetres.

Butt Weld Bend Test.—Two test pieces similar to those required for butt weld tensile test pieces are to be prepared. The thickness of the plate to be used in one test piece is to be 9·5 mm. and in the other 22·5 mm. The test pieces are to withstand without fracture being bent to an angle of 90 degrees over a bar whose diameter equals four times the thickness of the plate. The wide part of the vee of the butt is to be in tension and the rough edge of the test piece may be removed by filing or grinding.

PERIODIC INSPECTION OF MAKERS' WORKS.

Section 5. All establishments, the names of which are printed in the Society's approved list, shall be subject to periodic inspection by the Society's Surveyors, who will carry out tests, as set forth below, on each of the electrodes.

These visits will take place as may be considered necessary by the Committee, but at least once a year. Tests are to be made on specimens of deposited material prepared as set forth in **Section 4,** and are to consist of a tensile test for all electrodes, and, in addition, elongation and bend tests for electrodes which comply with the provisions of **Section 4, clause 9.**

The specimen for tensile and elongation tests need only be long enough to permit of the elongation being measured over a distance of 38 mm.; if this gauge length is adopted, the elongation is to be 23 per cent.

The test pieces may be prepared at the Makers' Works, where the tests also may be carried out.

The Committee may require, in any particular case, such additional tests as may be considered necessary.

71, Fenchurch Street, London, E.C.3.
8th April, 1937.

By order of the Committee,
MALCOLM K. SCOTT,
Secretary.

RULES FOR THE SURVEY AND CONSTRUCTION OF ENGINES AND BOILERS OF STEAM VESSELS.

Section 1. In vessels propelled by steam engines, the materials used in the construction of the machinery and boilers are to comply with the **Rules for the Quality and Testing of Materials.** The machinery and boilers are to be inspected throughout, the boilers tested by hydraulic pressure, and the machinery tested under steam by the Society's Engineer-Surveyors, who will furnish a report to the Committee. If found satisfactory the Committee will thereupon grant a certificate, and insert in the Register Book the notification, "LMC" *in red* (*i.e.* "LLOYD'S MACHINERY CERTIFICATE"), indicating that the machinery and boilers are certified to be in good order and safe working condition.

Section 2. 1. In steam vessels built under Special Survey, the machinery and boilers (including Press Boilers and similar apparatus for floating whale-oil factories) must also be constructed under Special Survey.

2. In cases of machinery or new boilers being built under Special Survey, the distinguishing mark ✠ will be noted in red, thus: "✠LMC," or "✠NE & B," or "✠NB."

3. In order to facilitate this inspection, the plans of the machinery and boilers are to be examined, and from them the working pressure fixed. Where superheating is employed, plans of the arrangements proposed for feed water heating and filtering are to be submitted for consideration.

4. Any novelty in the construction of the machinery or boilers is to be reported to the Committee.

5. The Surveyors are to examine the materials and workmanship from the commencement of the work until the final test of the machinery under steam; any defects, &c., to be pointed out as early as possible.

6. The Surveyors may also, if desired, compare the work as it progresses with the requirements of the specification agreed upon by the parties concerned, and certify to the conditions thereof, as far as can be seen, being satisfactorily complied with.

7. The machinery and boilers are to be securely fixed to the vessel to the satisfaction of the Surveyor.

Section 3. 1. **Feed Pumps.**—All steam vessels are to be provided with at least two entirely separate means of supplying the main boilers with feed water, when working at full power.

2. If the main feed supply is from pumps worked from the main engines, then with engines above 70NHP, there are to be two main feed pumps, so arranged that either can be shut off and overhauled while the other is at work. Each pump is to be capable of performing the whole work required.

3. In engines of 70NHP and under, and also in all engines of steam tugs and tenders, one main feed pump worked from the main engines will be approved, provided the auxiliary feed pump required by **clause 5** is fitted.

4. The main feed pumps may be worked by independent engines provided they are fitted with automatic regulators for controlling their speed. If only one such pump is fitted for the main feed the auxiliary feed pump required by **clause 5** is also to be fitted with an automatic speed regulator.

5. (*a*) An independent power pump is to be provided as an auxiliary feed supply, capable of performing the whole work required of feeding the boilers at full power, and is to be fitted with suctions to the hotwell and to the sea.

(*b*) This pump may also be used for general purposes, but in this case the suction pipes to the bilges are to be entirely distinct from those to the hotwell, tanks or sea.

The suction valves to the hotwell or feed water drain tanks are to be of non-return type.

Section 4. 1. **Bilge and General Service Pumps.**—The main engines are to be fitted with two bilge pumps so arranged that one can be overhauled whilst the other is at work.

2. In engines of 70 NHP and under and also in engines of steam tugs and tenders, one bilge pump worked from the main engines will be sufficient, provided the independent power pump required by **clause 4** is fitted.

3. In lieu of bilge pumps worked from the main engines, an independent power pump may be fitted additional to that required by **clause 4.**

4. An independent power pump is to be provided connected to the main bilge system as required in **clause 5.**

5. (*a*) Each power bilge pump is to be arranged to draw water from any hold or machinery compartment of the vessel, except where manual pumps only are permissible.

(*b*) Each power bilge pump required by the preceding clauses is to be capable of giving a speed of water through the pipes of the largest diameter required by the formula in **Section 34, clause 9,** of the **Rules for Steel Vessels,** of not less than 122 m. per minute, under ordinary working conditions.

Where, however, two bilge pumps are worked from the main engines, the capacity of each main engine bilge pump may be half that required above.

Alternatively, the capacity of the main engine bilge pumps may be less than that required above, provided the deficiency be made good by the independent power pump connected to the main bilge line.

(*c*) All power pumps which are essential for bilge service are to be of self-priming type.

(*d*) At least one of the independent power pumps (**clauses 3, 4**) is to be fitted with a direct suction to the machinery space (or to each engine room and boiler room where these compartments are separated by watertight bulkheads), which can be used while the other bilge pumps are being used on other parts of the vessel. (*See* **Section 34, clause 3, paragraph** (*c*)**, Rules for Steel Vessels.**)

This suction is to be led direct to the suction valve chest of the pump.

(*e*) The bilge suctions in machinery spaces are to be led from easily accessible mud-boxes placed, where practicable, above the level of the working floor, with straight tail pipes to the bilges, and having covers secured in such a manner as to permit of them being expeditiously opened and closed. The suction ends in hold spaces are to be enclosed in strum-boxes having perforations not more than 10 mm. in diameter whose combined area is not less than twice that of the suction pipe, and the boxes are to be so constructed that they can be cleared without breaking any joint of the suction pipe. Suction pipes in tunnel wells are to have similar strum-boxes.

6. The main water circulating pumps are to be fitted with direct bilge suction connections, provided with non-return valves, to the lowest level in the machinery space and of a diameter at least two-thirds that of the sea inlet.

Where only one bilge injection is fitted, as in single screw vessels, this suction and the independent power pump direct bilge suction are to be fitted at opposite sides of the engine room, except in the case of vessels having open floors in the machinery space and a rise of floor not less than 5°, when these suctions are to be fitted as near the centre line as practicable.

7. One of the power pumps referred to in **clauses 3** and **4** is to be fitted to draw from the sea and to deliver water on deck, and the arrangements are to be such that (except in the case of trawlers, tugs, yachts, and other small vessels) the water service can be used at both ends of the vessel at the same time.

8. Two independent means are to be provided for circulating water through the main condenser.

The sea-suction of the stand-by circulating water pump is to be independent of the main injection. The ballast pump sea suction may be used for this purpose.

Section 5. Twin Screw Vessels.—In vessels fitted with twin screw engines, the main feed pumps and the main engine bilge pumps may be fitted, one of each on each engine, provided they are so connected that each feed pump can deal with the water from both hotwells, and that each bilge pump can draw from all parts of the vessel.

Section 6. 1. Pipes, General.—All discharge pipes are to be fitted with discharge valves, which are to be secured to the plating of the vessel in accessible positions.

2. Pipes which pass through coal bunkers are to be protected efficiently.

3. Lead pipes are neither to be used within coal bunkers nor are they to be attached to bunker bulkheads.

Section 7. 1. Steam Pipes.—In all steam pipes provision is to be made for expansion and contraction to take place without unduly straining the pipes. Where the provision for expansion is by means of bends in the pipes the various lengths of pipes are to be made short of the designed lengths by amounts equal to about half the calculated expansion at the temperature of the steam.

2. **Drainage of Steam Pipes.**—Suitable provision is to be made for draining all steam pipes. The number and position of the drain cocks or valves are to be such that water may be efficiently drained from any portion of the steam pipes or valve chests, and arrangements are to be made for ready access to the drain cocks or valves.

Plans of the proposed arrangements are to be submitted for consideration.

3. For the thicknesses and tests of copper, iron, or steel steam and other pipes *see* **Section 13.**

4. Pipes conveying steam should not be led through spaces which may be used for cargo, except with the approval of the Committee. If these pipes are led through shaft tunnels or duct keels, they should be efficiently secured and insulated.

Section 8. Steam Turbine Engines.—In single screw vessels fitted with steam turbine engines the arrangements are to be such that steam can be led direct to the L.P. Turbine and either the H.P. or I.P. Turbine can exhaust direct to the condenser. Two turbines are to be fitted with astern wheels.

Section 9. Forced Lubrication.—In all vessels fitted with steam engines above 70 NHP in which the lubricating oil is circulated under pressure, a spare oil pump is to be supplied with all connections ready for immediate use and two independent means are to be arranged for circulating water through the oil cooler.

COCKS, PIPES, SEA CONNECTIONS AND PUMPING ARRANGEMENTS.

(*See also* **Section 34 of the Rules for Steel Vessels.**)

Section 10. 1. All sea cocks and valves required to be fitted on the plating of the vessel are to be fixed in easily accessible places above the level of the stokehold and engine room platforms, or are to be fitted on strong iron or steel stands of a height sufficient to lift them up to the level of these platforms.

2. The bolts securing all cocks or sea connections to the plating of the vessel are to be tapped into the plating of the vessel or fitted with countersunk heads.

3. Where sea valves are provided with clearing connections from steam or compressed air lines, the scantlings of the valves and the valve stools, if fitted, are to be suitable for the maximum pressure to which the valves or stools may be subjected.

4. All suction and discharge valves and cocks on the plating of the vessel are to be fitted with spigots passing through the plating.

Blow-off cocks on the plating of the vessel are, in addition, to be fitted with a brass or gun-metal ring on the outside, and the cocks are to be so constructed that the key or spanner can only be taken off when the cock is shut. (*See* **Section 19, clause 3.**)

5. (*a*) The arrangement of pumps, valves and their connections are to be such as to prevent the possibility of water passing from the sea or from water tanks into the cargo or machinery spaces, or from one compartment to another. To effect this requirement, the bilge connection to any pump having also a suction from the sea should be made either by means of a non-return valve or a cock which cannot be open at the same time to the sea, or to water tanks and to the bilges. Valves in all bilge distribution boxes are to be of the non-return type.

(*b*) Cocks and valves connecting all bilge suction pipes are to be fixed in accessible places above the stokehold and engine room platforms.

(*c*) All pipes from the pumps which are required for draining cargo or machinery spaces are to be entirely distinct from pipes which may be used for filling or emptying spaces where water is carried.

RULES FOR SHAFTS.

Section 11. 1. **General.**—(*a*) All shafts are to be turned all over and are to be examined when rough turned and when finished.

(*b*) Gauges of an approved description for testing the truth of the crank shafts of Reciprocating Engines are to be supplied with all new engines, and adjusted in the presence of the Surveyor. Where Steam Turbine Engines are fitted, gauges for testing the truth of the rotor, pinion and gear wheel shafts are to be supplied, and adjusted in the presence of the Surveyor.

2. **Materials for Shafts.**—(*a*) Shafts may be forged from ingot steel, wrought iron bars piled, or scrap wrought iron, and they may be wrought by hammer, press, or where in straight lengths, by rolling mill.

(*b*) Mild steel scrap may be used for intermediate shafts but not for crank, thrust, tube or screw shafts.

(*c*) If scrap is used it must be of uniform quality and be thoroughly cleansed. A mixture of iron and steel scrap is not permitted in any case.

(*d*) Where ingot steel is used for shafts it is to comply generally with the requirements of **Section 10** of the **Rules for the Quality and Testing of Materials.**

(*e*) Where ingot steel shafts are made by rolling and the couplings are formed from the shafts by upsetting, the test pieces may be cut from the outer edges of the couplings.

3. **Materials for Couplings.**—(*a*) Couplings of wrought iron shafts may be welded to the body of the shaft, but those of ingot steel shafts are to be forged from the solid or by upsetting the ends by hydraulic pressure.

(*b*) Couplings, where separate from the shaft, may be forged from ingot steel, wrought iron, or mild steel scrap; or they may be steel castings.

4. **Materials for Crank Shaft Webs.**—(*a*) Webs of built crank shafts may be forged or rolled from ingot steel, wrought iron, or mild steel scrap; or they may be steel castings.

(*b*) The material of cast steel webs is to such that the tensile strength does not exceed 50 kg. per mm². and in no case is the sum of 0,64 times the tensile breaking strength in kilogrammes per mm². and the percentage of elongation, measured on a standard test piece, to be less than 50.

Section 12. 1. **Dimensions of Shafts.**—The dimensions of the shafts of steam engines are not to be less than those given by the following formulæ :—

2. **Steam Reciprocating Engines.**—The diameter of the intermediate shafts is not to be less than that given by the following formula :—

Diameter of intermediate shaft, in millimetres =

$$\sqrt[3]{\frac{D^2 \times S \times WP \times 14{,}22}{C\,(r+2)}}$$

where **D** is the diameter in millimetres of the low pressure cylinder or the equivalent diameter where two or more low pressure cylinders are fitted,

S is the stroke of the piston in millimetres,

WP is the working pressure in the boiler in kilogrammes per cm².

r is the ratio of the areas of the low pressure cylinder or cylinders to that of the high pressure cylinder or cylinders,

C is a coefficient given in the following Table :—

COMPOUND, TRIPLE, OR QUADRUPLE EXPANSION RECIPROCATING ENGINES.	VALUES OF "C."	
	Ocean Going and Home Trade Vessels.	Vessels trading on Estuaries, Rivers, Lochs and Lakes.
2 cranks at 90° ...	1900	2100
2 cranks at 180° ...	1350	1500
3 cranks at 120° ...	2150	2400
4 cranks balanced...	2150	2400
4 cranks at 90° ...	2100	2300

3. **Crank Shafts.**—The diameter of the crank shafts is not to be less than 1,05 times that required for the intermediate shaft.

4. **Crank Webs of Built Shafts.**—(*a*) The dimensions of the crank webs of built shafts are not to be less than those given by the following formulæ :—

$$h = 0{,}625 \times d$$

$$t = \sqrt{\frac{0{,}12 \times d^3}{h}}$$

where h is the thickness of the web, measured parallel to the axis, in millimetres,

t is the thickness of metal around the eyeholes, measured radially, in millimetres,

d is the diameter required for the crank shaft in millimetres.

(*b*) Crank webs are to be securely shrunk on the body pieces and crank pins, or to be forced on by hydraulic pressure. One or two keys or cylindrical dowels are to be fitted at the junction of the body pieces and webs.

The Committee will be prepared to give consideration to the circumstances of any special case.

5. **Thrust Shafts.**—The diameter at the collars of thrust shafts transmitting torque is not to be less than 1,05 times that required for the intermediate shaft. Thrust shafts may be tapered down outside the collars to the diameter required for the intermediate shaft.

6. **Tube Shafts** (Shafts passing through stern tubes but not carrying the screw propellers).—The diameter of the tube shaft is not to be less than 1,05 times that required for the intermediate shaft, and any part of the shaft within the tube which may be exposed to sea water is not to be less than 1,075 times that required for the intermediate shaft.

7. **Screw Shafts** (Shafts carrying the screw propellers).—(*a*) The diameter of the screw shaft is not to be less than that given by the following formula :—

Diameter of screw shaft, in millimetres = $d + \frac{P}{C}$

where d is the diameter required for the intermediate shafts, in millimetres.

P is the diameter of the propeller, in millimetres.

C = 144 when the shaft is fitted with a continuous liner, or

C = 100 when the shaft is not fitted with a continuous liner

(*b*) Screw shafts which run in stern tubes may have the end forward of the stern gland tapered down to a diameter, at the coupling flange, of 1,05 times d.

8. **Bronze Liners on Shafts.**—(*a*) The thickness of liners fitted on screw shafts or on tube shafts, in way of the bushes, is not to be less than that given by the following formula :—

$$t = \frac{d + 235}{32}$$

where t is the thickness of the liner, in millimetres.
d is the diameter required for the screw or tube shaft under the liner in millimetres.

(*b*) The thickness of a continuous liner between the bushes is not to be less than 0,75t.

(*c*) Continuous liners should be cast in one piece or, if made of two or more lengths, the junctions of the separate pieces are to be made by fusion through the whole thickness of the liner.

(*d*) Liners are to be carefully shrunk on, or forced on to the shafts by hydraulic pressure. Pins are not to be used to secure the liners.

(*e*) If the liner does not fit tightly between the bearings in the stern tube, the space between the shaft and the liner is to be charged or forced with a plastic material insoluble in water and non-corrosive.

(*f*) Effective means are to be provided for preventing water from having access to the shaft at the part between the after end of the liner and the propeller boss.

9. **Stern bush.**—The length of the bearing in the stern bush next to and supporting the propeller is not to be less than four times the diameter required for the screw shaft under the liner.

10. **Couplings.**—(*a*) The diameter of the coupling bolts at the joining faces of the couplings is not to be less than that given by the following formula :—

Diameter of coupling bolts, in millimetres =

$$\sqrt{\frac{d^3}{3{,}5 \times n \times r}}$$

where d is the diameter required for the intermediate shafts, in millimetres,
n is the number of bolts in the coupling,
r is the radius of the pitch circle of the bolts, in millimetres.

(*b*) The thickness of the coupling flanges at the pitch circle of the bolt holes is not to be less than the diameter of the coupling bolts at the face of the coupling. The thickness of the screw shaft coupling flange is not to be less than 0,25 of the diameter required for the intermediate shaft.

(*c*) The radius of curvature at the fillet where the flange starts from the shaft should not be less than 0,125 the diameter of the shaft adjacent to the flange.

(*d*) Where couplings are separate from the shafts provision is to be made to resist the astern pull.

11. **Bronze Propellers.**—Where bronze is used for propellers or propeller blades, it is to comply with the requirements of **Section 11** of the **Rules for Quality and Testing of Materials.**

12. **Steam Turbine Engines and Electric Propelling Motors.**—The diameter of the intermediate shafts is not to be less than that given by the following formula :—

Diameter of intermediate shaft, in millimetres =

$$25{,}4 \times \sqrt[3]{\frac{SHP}{R} \times F}$$

Where SHP is the maximum designed shaft horse power,
R is the number of revolutions per minute at that power.
F = 64 for ocean going and home trade vessels.
F = 58 for vessels trading on estuaries, rivers, lochs and lakes.

13. **Wheel Shafts of Geared Steam Turbine Engines.**—(*a*) Where there are two pinions geared into the wheel, opposite, or nearly opposite, to one another, the diameter of the wheel shaft is not to be less than 1,05 times that required for the intermediate shaft.

(*b*) Where there is only one pinion geared into the wheel, or where there are two pinions which are set to subtend an angle at the centre of the shaft of less than 120°, the diameter of the shaft at the wheel and the adjacent journals is not to be less than 1,1 times that required for the intermediate shaft. Abaft the journals the shaft may be tapered to 1,05 times the diameter required for the intermediate shaft.

14.—**Steam Reciprocating Engines combined with Exhaust Steam Turbines.**

Where steam reciprocating engines are combined with exhaust steam turbines, either by means of mechanical gearing or by electric generators and motors, the diameter of the intermediate shafting is not to be less than that given by the following formula, viz. :—

$$d = 25{,}4 \times \sqrt[3]{\frac{SHP \times 64}{R}}$$

where d = diameter of intermediate shaft in millimetres.
SHP = 0·9 indicated horse-power, of the reciprocating engines when working with the turbine + ·95 shaft horse-power of the exhaust turbine at the turbine shaft.
R = Revolutions per minute of the main propelling shafting.

In no case is the diameter of the intermediate shafting to be less than that required by the Rules for ordinary reciprocating engines when working without a turbine.

15. For dimensions of thrust, tube, and screw shafts, shaft liners, stern bush, shaft couplings and coupling bolts *see* **clauses 5 to 10.**

STEAM AND OTHER PIPES.

Section 13. 1. Pipes made from the electro deposition of copper on a mandril are not to be used for steam, feed delivery, blow-off or scum.

2. All copper steam, feed, blow-off and scum pipes are to be properly annealed before fixing in place.

3. All copper pipes used for steam, feed, blow-off and scum purposes subject to a pressure over 5,25 kg. per cm². are to be solid drawn.

4. Steam pipes intended for a working pressure over 12,65 kg. per cm². are not to be of copper when the internal diameter exceeds 125 mm. Copper pipes are not to be used for superheated steam.

5. All copper steam pipes on completion and prior to being fitted in place are to be subjected to an hydraulic test of at least twice the working pressure to which they will be subjected.

6. All copper feed delivery pipes are to be hydraulically tested to at least 2,5 times the working pressure of the boilers.

7. The working pressure to be allowed on copper pipes is to be determined by the following formula :—

$$WP = \frac{(t - 0{,}8) \times F}{D}$$

Where **WP** is the working pressure in kilogrammes per cm².,

D is the internal diameter in millimetres,

t is the thickness in millimetres,

F for solid drawn steam pipes = 422,
for solid drawn feed pipes = 337,
for brazed steam pipes = 316,
for brazed feed pipes = 253.

8. Where copper pipes are bent they are to be made thicker than required by **clause 7** to provide for the thinning at the bend. In no case is the radius of curvature at the centre line of the pipe to be less than twice the external diameter of the pipe.

9. Steam and other pipes may be made of wrought iron or wrought steel.

10. The process of welding the seams of iron or steel pipes is to be such that it is done by hammering or rolling the joint.

11. On completion of any work on iron or steel steam pipes which involves heating whether for welding the joint, welding on flanges, bending the pipe or for any other purposes the pipes are to be carefully annealed.

12. Where steam and other pipes are made of steel, the material is to comply with the requirements of **Section 16** of the **Rules for Quality and Testing of Materials.**

13. Feed pipes if made of steel are to be solid drawn, cold finished.

14. All iron or steel steam pipes prior to being fitted in place are to be subjected to an hydraulic test of at least three times the working pressure to which they will be subjected.

15. All iron or steel feed delivery pipes are to be hydraulically tested to at least four times the working pressure of the boilers.

16. The working pressure to be allowed upon iron or steel steam and feed pipes is to be determined from the following formulæ :—

a. For solid drawn cold finished steel steam pipes,

$$WP = \frac{(t - 2{,}5)}{D} \times 844$$

b. For solid drawn hot finished steel steam pipes,

$$WP = \frac{(t - 3)}{D} \times 844$$

c. For lap-welded steam pipes of iron or steel whether with or without covering straps,

$$WP = \frac{(t - 3)}{D} \times 633$$

d. For feed delivery pipes,

$$WP = \frac{(t - 2)}{D} \times 703$$

Where **WP** is the working pressure in kilogrammes per cm². to which the steam pipes will be subjected, and in the case of feed delivery pipes is the boiler pressure,

D is the internal diameter of the pipes in millimetres ;

t is the thickness in millimetres.

CYLINDRICAL BOILERS.

Section 14. 1. **General.**—In the design and construction of Marine Boilers the following conditions are to be observed:—

2. Shell plates subject to a direct tensile stress may be welded in cases where the weld is covered by a riveted butt strap or straps.

Proposals to omit butt straps may be considered, provided full details are submitted before the work is commenced.

3. All steel plates which are welded, dished, flanged, or locally heated are to be afterwards efficiently annealed.

4. Butt straps are to be cut from plates and not from rolled slips.

5. All rivet holes are to be drilled, and as far as possible they are to be drilled in place. After drilling the plates the burrs are to be removed and the faying surfaces of the plates cleaned, and the sharp outer edges of holes removed also.

6. Steel stays are not to be welded. If plus threads are desired, the ends of the stay bars may be upset or the bars may be drawn down in the central portions from bars originally of the size of the ends. In either of these two cases the bars are to be subsequently annealed throughout. In double ended boilers the through longitudinal stays are to be supported at or near the middle of their length.

7. Screw stays of combustion chambers where fitted with nuts, are to be, as far as possible, normal to the chamber plates. Where this is not possible they are to be fitted with taper washers to provide a fair bed for the nuts.

8. Nuts to screw stays in combustion chambers are to be not less than 19 mm. thick for stays up to 38 mm. diameter over threads, 22 mm. thick for 41 and 45 mm. stays, 25 mm. thick for 48 and 51 mm. stays, and 29 mm. thick for stays over 51 mm. in diameter. The nuts are to be made of solid mild steel or of iron which is to be without weld.

9. Screw stays 32 mm. in diameter and upwards should have 9 threads per 25,4 mm., and all stays 51 mm. in diameter and above passing through plates and secured by nuts on each side of the plate, should have not more than 6 threads per 25,4 mm.

10. Where jointed longitudinal stays are fitted between the front and back tube plates they are to be fitted with pins having an effective sectional area 25 per cent in excess of that of the stay. The pins may be slack in the holes, the total slackness being not more than 1,5 mm. The pins are to be as close as possible to the shoulder of the eye forging. The shoulder of the forging is to have a diameter not less than 25 mm. greater than the diameter of the hole.

Section 15. 1. **Dampers and Baffles.**—Boilers, whether main or auxiliary, in which fuel oil only is used are not to be fitted with a damper, or other possible means of obstruction to draught, in the uptake or funnel.

If the boilers are to use coal and oil fuel alternately, the uptake or funnel dampers, if fitted, must be provided with a suitable device whereby they may be securely locked in the fully open position.

2. The end plates in the steam space in way of uptakes are to be shielded from contact with the heated gases.

Section 16. 1. **Access Arrangements.**—(*a*) Manholes in cylindrical shells are to have their shorter axes arranged longitudinally. Where the cylindrical shell is cut for a manhole, compensation is to be provided and is to be such that the strength in way of the hole is not less than that required for the longitudinal joint.

(*b*) Where a flat plate is flanged to stiffen it at a manhole or sight hole, to permit the same working pressure as would be allowed upon an unpierced plate the depth of the flange measured in millimetres from the outer surface is to be at least equal to $\sqrt{t \times w}$ where t is the thickness of the plate in millimetres and w is the minor axis of the hole in millimetres.

2. The doors to manholes, mudholes, and sight holes are to be built up or pressed to shape and annealed, or made from one thickness of plate with a machined recess for the jointing material. Their spigot part or the recess is not to have a greater clearance than 1,5 mm. all round, *i.e.*, the axes are not to be less than 3 mm. smaller than the holes in which they are fitted.

3. The studs for securing all doors are to be screwed through the plate, and they are to be fitted with nuts on the inside or bolts may be used screwed through the plate with the heads inside.

4. All boilers are to be provided, where possible, with means for ingress to permit of examination and cleaning of the inner surfaces of plates and tubes exposed to flame. Where the boilers are too small to permit of this there are to be sight holes and mudholes sufficiently large and numerous to permit of the inside being satisfactorily cleaned.

5. Where the cross tubes of vertical boilers are large there is to be a sight hole in the shell opposite to one end of each tube sufficiently large to permit the tube to be examined and cleaned. These sight holes are to be in positions accessible for that purpose.

Section 17. Hydraulic Tests.—In all new boilers working at pressures up to 7 kg. per cm². the hydraulic test is to be twice the working pressure. For boilers working at pressures greater than 7 kg. per cm². the hydraulic test pressure is to be 1,5 times the working pressure plus 3,5 kg. per cm².

Section 18. 1. **Water Gauges and Test Cocks.**—Every boiler is to be fitted with at least two independent means of indicating the water level in it, and have marked on it in a contiguous position, easily seen, the level of the highest part of the combustion chamber. One of these means is to be a glass gauge or an equivalent. The other may be a set of test cocks.

(In the case of boilers of tugs, tenders, coasting and other small vessels engaged on short voyages, and in that of vertical boilers, the marking of the level of the highest part of the combustion chamber may be omitted.)

2. Test cocks, where practicable, are to be fitted direct on the boiler shell. A set is to consist of at least three cocks except in boilers 2,30 m. in diameter and under when there may be two. For vertical boilers above 2,15 m. high, the set of test cocks is to consist of at least three.

3. All single-ended boilers 4,90 m. mean diameter or over, are to be fitted with a glass water gauge on each side. Single-ended boilers under 4,90 m. in diameter are to be fitted with one glass water gauge and one set of test cocks, or the equivalent of the latter.

4. All double-ended boilers are to be fitted with a glass water gauge at, or, near each end on opposite sides and a set of test cocks at each end, or the equivalent of the latter.

5. The cocks of all water gauges are to be accessible from positions free from danger in the event of the glass breaking.

6. If the water gauges are not fitted directly to the shell of the boiler but to stand pillars or columns, it is desirable that these pillars or columns should be bolted directly to the shell of the boiler. If they are connected to the boiler by means of pipes the pipes are to be fitted with terminal cocks, not valves, secured direct to the boiler shell. For boilers exceeding 3 m. in diameter the pillars are not to be less than 63 mm. and the connecting pipes not less than 38 mm. internal diameter. For boilers exceeding 2,30 m. but not exceeding 3 m. in diameter the pillars are not to be less than 50 mm. and the pipes not less than 32 mm. internal diameter, and for boilers 2,30 m. in diameter and under the pillars are not to be less than 45 mm. and the pipes not less than 25 mm. internal diameter. The upper ends of the connecting pipes are to be arranged so that there is no pocket or bend where an accumulation of water from the condensation of the steam can lodge. They should not pass through the uptake if they can be otherwise arranged. If, however, this condition cannot be complied with, they may pass through it by means of a passage at least 50 mm. clear of the pipe all round, open for ventilation.

7. A **Salinometer cock or valve** is to be fitted direct to each boiler in a convenient position. It must not be on the water gauge stand-pipe.

8. **Pressure gauges.**—Each boiler is to be provided with a separate steam pressure gauge. Double-ended boilers are to be provided with a pressure gauge at each end. The gauges are to be placed where they are easily seen.

9. **Feed Checks.**—Each boiler is to be fitted with at least two independent means of feed, each with its own check valve. In auxiliary or winch boilers one of the means of feed may be an injector.

Section 19. 1. **Blow-off and Scum Valves.**—Each boiler is to be fitted with a blow-off valve secured direct to the shell. The valve and its connections to the sea need not be more than 38 mm. in diameter, and may be generally about 8,5 mm. in diameter for each metre in diameter of the boiler. It is, however, to be not less than 20 mm. in diameter.

Vertical boilers are to be fitted with a blow-off cock or valve.

2. Blow-off valves and scum valves (where these latter are fitted) of two or more boilers may be connected to one common discharge, but where thus arranged there are to be screw-down non-return valves fitted for each boiler to prevent the possibility of the contents of one boiler passing to another.

3. The blow-off cock or valve on the ship's side is to be fitted above the level of the stokehold plates, in an accessible position, and is to be arranged so that it can be readily seen whether it is open or shut. The cock handle is not to be capable of being removed unless the cock is shut, and if a valve is fitted the wheel is to be fixed to the spindle. The cock or valve is to be fitted with a spigot passing through the plating and a brass or gun-metal ring on the outside.

Section 20. Stop Valves.—One main stop valve is to be fitted to each boiler secured direct to the shell. There are to be as few auxiliary stop valves as possible so as to

avoid piercing the boiler shell more than is absolutely necessary. The arrangement, however, is to be such that where more than one boiler is fitted it is possible to supply the steam whistle, the steam steering gear, and the electric light machinery from at least two boilers.

Section 21. 1. **Safety Valves.**—At least two safety valves are to be fitted to each boiler. They are to be arranged so that the springs and valves are cased in, that the valves cannot be overloaded when steam is up, that they can be lifted by easing gear, and turned round on their seats by hand, and in case of fracture of springs they cannot lift out of their seats. Easing gear is to be arranged to lift all the safety valves on a boiler together, and is to be workable from some accessible place, free from steam danger.

2. Vertical boilers having 9,3 m²., or more, of total heating surface are to be fitted with two safety valves each not less than 38 mm. diameter; those having less than 9,3 m². may have one valve not less than 50 mm. diameter.

3. All the safety valves of each boiler may be fitted in one chest, which is to be separate from any other valve chest and is to be connected direct to the boiler by a strong and stiff neck, the passage through which is to be of not less cross-sectional area than one-half the aggregate area of the safety valves in the chest. Each safety valve chest is to be provided with a means by which it can be drained; the drain pipe is to be lead to the bilge or to a tank, clear of the boiler.

4. (*a*) The minimum aggregate area of the safety valves of the ordinary type for saturated steam fitted to each boiler, whether coal fired or oil fired, and whether working under natural, forced, or induced draught is to be found by the following formula:—

$$\text{Aggregate area of safety valves in mm}^2. = \frac{\text{T.H.S.} \times \text{E} \times 21}{\text{p} + 1{,}05}$$

where T.H.S. is the total external surface in square metres of the tubes and other parts of the boiler exposed to heat, so as to cause evaporation.

p is the working pressure in kilogrammes per cm².

E is the estimated evaporation in kilogrammes per square metre of heating surface (T.H.S.) per hour *with* a *minimum value of* 29.

(*b*) For superheated steam, the aggregate area of the safety valves is to be found by the following formula:—

$$A_s = A \times (1 + 0{,}0018\ T)$$

where A_s is the aggregate area of the safety valves for superheated steam, in mm².

A is the aggregate area of the safety valves found by the formula in paragraph (*a*).

T is the degree of superheat, in degrees centigrade.

(*c*) An approved type of safety valve of equally good and reliable design may be fitted in lieu of those described in the Rules.

(*d*) In the case of high lift safety valves of approved type, the aggregate area of safety valves, as calculated from either of the above formulæ, may be reduced by not more than 50 per cent.

5. The waste-steam pipe and the passages leading to it are to have a cross-sectional area not less than 1,1 times the combined areas of the safety valves as given by the above formula.

6. All safety valves are to be set to the required pressure under steam. During a test of 15 minutes with the stop valves closed and under full firing conditions the accumulation of pressure is not to exceed 10 per cent of the loaded pressure. During this test no more feed-water should be supplied than is necessary to maintain a safe-working water level.

Section 22. 1. **Boiler Mountings.**—All boiler mounting valves are to be subjected to an hydraulic test of twice the working pressure. Valves over 38 mm. diameter are to be fitted with outside screws and the covers are to be secured by bolts or studs. All valves are to be arranged to be shut with a right-hand motion of the wheels.

2. All cocks and valves connected to the boiler are to be such that it is seen without difficulty whether they are open or shut. Where boiler mountings are secured by studs, the studs are to have a full thread holding in the plate for a length of at least one diameter. If the stud hole penetrates the whole thickness of the plate the stud is to be screwed right through the plate and is to be fitted with a nut inside the boiler. Where bolts are used for securing mountings they are to be screwed right through the plate with their heads inside the boiler.

3. Where a superheater is fitted which can be shut off from the boiler it is to be provided with a separate safety valve fitted with easing gear. The valve as regards construction is to comply with the regulations for ordinary safety valves, but the easing gear may be fitted to be workable from the stokehold only. The superheater is also to be fitted with a drain cock or valve to free it from water when necessary.

4. Safety valve chests, main engine stop valve chests, and all other steam pipe valves and fittings where subjected to saturated steam only may be made of cast iron, but such valve chests and steam pipe fittings where subjected to steam of a temperature above 218° C. are to be of cast steel or other approved material.

RULES FOR DETERMINING THE WORKING PRESSURE TO BE ALLOWED IN NEW BOILERS.

Cylindrical Shells.

Section 23. 1. For the cylindrical shells of steel marine boilers the maximum working pressure (which is designated by WP and is in kilogrammes per cm².) to be allowed is to be calculated from the following formulæ :—

Where the thickness of the shell plates does not exceed 45 mm.

$$WP = \frac{(t-1{,}6) \times S \times J}{C \times D}$$

Where the thickness of the shell plates exceeds 45 mm. and the longitudinal seams are made with double butt straps.

$$WP = \frac{t \times S \times J}{2 \times D}$$

In the above formulæ

t is the thickness of the shell plates in millimetres,

S is the minimum tensile strength of the steel shell plates in kilogrammes per mm².,

J is the percentage of strength of the longitudinal seams calculated by the methods described hereafter,

C is a coefficient, which is 1,92 where the longitudinal seams are made with double butt straps, 1,98 where the longitudinal seams are made with lap joints and are treble riveted, 2,03 where they are made with lap joints and are double riveted and 2,31 where they are made with lap joints and are single riveted,

D is the inside diameter of the outer strake of plating of the cylindrical shell measured in millimetres.

2. The percentage of strength of a riveted joint (**J**) is found from the following formulæ (i), (ii), (iii) : (i) and (ii) are applicable to any type of joint, (iii) is applicable only to that type of joint in which the number of rivets in the inner rows is double that in the outer row. The lowest value given by the application of these formulæ is to be taken as the percentage of strength of the joint.

(i) Percentage of strength of plate at joint as compared with solid plate $= \frac{100\,(p-d)}{p}$

(ii) Percentage of strength of rivets as compared with solid plate

$$= \frac{100\,(S_2 \times a \times n \times C)}{S_1 \times p \times T}$$

(iii) Percentage of combined strength of the plate at the inner row of rivet holes and of the rivets in the outer row

$$= \frac{100\,(p-2\,d)}{p} + \frac{100\,(S_2 \times a \times C)}{S_1 \times p \times T}$$

where p = pitch of rivets at outer rows in millimetres,

d = diameter of rivet holes in millimetres,

a = sectional area of one rivet in mm².,

n = number of rivets which are fitted in the pitch p,

T = thickness of plate in millimetres,

C = 1,0 for rivets in single shear as in lap joints,

C = 1,875 for rivets in double shear as in double butt-strapped joints,

S_1 = minimum tensile strength of plates in kilogrammes per mm².,

S_2 = shearing strength of rivets, which is taken generally to be 36 kg. per mm². and may be 85 per cent of the minimum tensile strength of the rivet bars.

3. Where the longitudinal seams are fitted with double butt-strapped joints, the outer butt strap is to be at least 0,625 of the strength of the plate, and is to be of sufficient thickness to permit of efficient caulking of its outer edges. The inner butt strap is to be 3 mm. thicker than this.

In cases where the number of rivets in the inner rows is double the number in the outer row, this will require the thickness of the outer strap to be

$$t_o = \frac{5 \times (p-d)}{8 \times (p-2\,d)} \times T,$$

and that of the inner strap to be at least

$$t_n = \frac{5 \times (p-d)}{8 \times (p-2\,d)} \times T + 3 \text{ mm.}$$

4. In all cases the clear space between a rivet hole and the edge of a plate is not to be less than the diameter of the rivet holes, *i.e.*, the centre of the rivet hole is to be at least 1,5 diameters distant from the edge of the plate.

In joints whether lapped or fitted with butt straps, in which there are more than one row of rivets and in which there is an equal number of rivets in each row, the distance between the rows of rivets is not to be less than 0,33 p + 0,67 d with zigzag riveting, or 2 d with chain riveting.

In joints in which the number of rivets in the outer rows is one-half of the number in each of the inner rows, and in which the inner rows are chain riveted, the distance between outer rows and the next rows is not to be less than 0,33 p + 0,67 d or 2 d, whichever is the greater, and the distance between the rows in which there are the full number of rivets is not to be less than 2 d.

In joints in which the number of rivets in the outer rows is one-half of the number in each of the inner rows, and in which the inner rows are zigzag, the distance between the outer rows and the next rows is not to be less than 0,2 p + 1,15 d, and the distance between the rows in which there are the full number of rivets is not to be less than 0,165 p + 0,67 d.

In the above p is the pitch of the rivets in the outer rows.

5. The maximum pitch of the rivets in the longitudinal joints of boiler shells is to be—

Maximum pitch in millimetres = $C \times T + 40$ mm.

where T is the thickness of the plate in millimetres and C is a coefficient as given in the following Table :—

Number of Rivets per pitch.	Coefficients for Lap Joints.	Coefficients for Double Butt-strapped Joint.
1	1,31	1,75
2	2,62	3,50
3	3,47	4,63
4	4,14	5,52
5	—	6,00

6. If holes are cut in the cylindrical shells of boilers for fixing of mountings, the diameters of the holes being greater than 2,5 times the thickness of the shell plating plus 70 mm., compensation is to be fitted as in the case of manholes. (*See* **Section 16, clause 1, paragraph** (*a*).)

7. Where more than three screw stays pierce the cylindrical shell in a horizontal line, if d is their diameter and p the pitch, $\frac{100\ (p - d)}{p}$ should not be less than the percentage of strength required for the shell longitudinal joints. If this is not possible, the stays are to be arranged out of line with one another longitudinally.

8. The riveting of the seams joining the end plates to the cylindrical shell is not to be less than 42 per cent of that of the solid shell plate. Where the shell plates exceed 16 mm. in thickness the seams connecting the shell plates to the end plates are to be at least double riveted. Where the shell plates exceed 13 mm. in thickness the intermediate circumferential seams of double-ended boilers are to be at least double riveted.

9. The circumferential seam at or near the middle of the length of single-ended boilers is to have a strength of joint not less than 60 per cent of the solid plate. The inner circumferential seams of double-ended boilers are to have a strength of joint not less than 62 per cent. of the solid plate. In any case there are to be at least three rows of rivets where single-ended boilers have shell plates over 35 mm. in thickness and where double-ended boilers have shell plates over 30 mm. in thickness.

10. The circumferential seams of the shells of vertical boilers are to have a strength of not less than 42 per cent of the solid plate. Where these seams are not complete circles, and where the shell plates exceed 16 mm. in thickness, the riveting is to be at least double.

Furnaces.

Section 24. 1. The working pressure to be allowed on corrugated furnaces is to be determined by the following formula :—

$$WP = \frac{C\ (t - 0{,}8)}{D}$$

where D is the external diameter measured at the bottom of the corrugations in millimetres,

t is the thickness of the furnace plate in millimetres, measured at the bottom of the corrugation or camber,

C is a coefficient which is 1080 for the Fox, Morison, Deighton, Purves, and other similar furnaces, and is 1150 for the Leeds Forge Bulb Suspension furnace.

2. The working pressure to be allowed on plain furnaces or furnaces strengthened by the Adamson or other joints, and on the cylindrical bottoms of combustion chambers, is to be determined by the following formulæ, the least pressure obtained by either formula being taken :—

$$WP = \frac{C\ (t - 0{,}8)^2}{(L + 610) \times D}$$

$$\text{or } WP = \frac{C_1}{D} \times [320\ (t - 0{,}8) - L]$$

where D is the external diameter of the furnace or combustion chamber in millimetres,

t is the thickness of the furnace plate in millimetres,

L is the length of the furnace or of combustion chamber bottom or the length between points of substantial support, in millimetres measured from the centres of rivet rows or from the commencement of flange curvature, whichever is applicable.

C is 104400 where the longitudinal seams are welded and 93600 where they are riveted,

C_1 is 3,5 where the longitudinal seams are welded and 3,16 where they are riveted,

WP is the working pressure in kilogrammes per cm².

3. Where the furnaces are tapered the diameter to be taken for calculation purposes is to be the mean of that at the top, and of that at the bottom where it meets the substantial support from flange or ring. The length for the same purpose is to be the distance from the centre of the row of rivets connecting the crown to the body of the furnace to the substantial support at the bottom of the furnace, or to a row of screwed stays connecting the furnace to the shell, provided the pitch of stays at the furnace does not exceed 14 times the thickness of the furnace plate where the stays are riveted at their ends, and 16 times where they are fitted with nuts. Such screwed stays are to be in diameter over the threads not less than 2,25 times the thickness of the furnace plate.

4. Where the furnaces are spherical in form and convex upwards at their tops, and are without support from stays of any kind :—

$$WP = \frac{620\ (t-0,8)}{R}$$

where t is the thickness of the top plate in millimetres,

R is the outer radius of curvature of the furnace in millimetres.

5. The working pressure to be allowed on internal uptakes of vertical boilers is to be determined by the following formulæ, the least pressure obtained by either formula being taken :—

$$WP = \frac{C(t-4)^2}{(L+610) \times D}$$

$$\text{or } WP = \frac{C_1}{D} \times [320(t-4) - L]$$

where **D** is the external diameter of the uptake in mm.,

t is the thickness of the uptake in mm.,

L is the length of the uptake between points of substantial support, in mm., measured from the centres of the rivet rows,

C is 104400 where the longitudinal seams are welded and 9360 where they are riveted,

C_1 is 3,5 where the longitudinal seams are welded and 3,16 where they are riveted.

WP is the working pressure in kgs. per cm².

6. The thickness of cross tubes in cross tube boilers shall be determined from the following formula, but shall in no case be less than 9,5 mm.

$$t = \frac{WP \times D}{450} + 5,6$$

where t = the minimum thickness in mm.

WP = the working pressure in kgs. per cm²,

D = the internal diameter of the cross tube in mm.

7. For the ogee ring which connects the bottom of the furnace to the shell, and sustains the whole load on the furnace vertically :—

$$WP = \frac{10100\ (t-0,8)^2}{D \times (D - d)}$$

where t is the thickness of the ogee ring in millimetres,

D is the inside diameter of the boiler shell in millimetres,

d is the outside diameter of the lower part of the furnace where it joins the ogee ring in millimetres.

8. Furnaces, plain or corrugated, are not to exceed 21 mm. in thickness.

Flat Plates supported by Stays secured in various ways.

Section 25. 1. The working pressure to be allowed on flat plates supported by stays is to be calculated by the following formula :—

$$WP = \frac{(t-0,8)^2 \times C}{a^2 + b^2}$$

In this formula and in that in **clauses 8 to 11**

WP is the working pressure in kilogrammes per cm².,

t is the thickness of the flat plate in millimetres,

t_w is the thickness of the washers, strips, or doublings employed also in millimetres,

a is the distance apart of the rows of stays in millimetres,

b is the pitch of the stays in the rows in millimetres.

C is a coefficient which varies with the method of fixing the stays as follows :—

Where the plates are exposed to flame and the stays are screwed into the plate and their ends are riveted over **C** = 3600. Where the plates are not exposed to flame and

the stays are screwed into the plate and their ends are riveted over $C = 4100$. In these cases the thickness of the plate is to be at least half the diameter of the stay required by the Rules.

Where stay tubes are screwed into tube plates and expanded $C = 3740$. If they are fitted with nuts $C = 5180$.

Where the plates are exposed to flame and the stays are screwed into the plate and fitted with nuts on the outside $C = 5400$. Where the plates are not exposed to flame $C = 6200$.

Where the stays pass through the plates not exposed to flame and are fitted with nuts inside and outside $C = 6900$, and where the plates are exposed to flame $C = 6050$.

2. Where plates are stiffened by flanging, the inner radius of which is not greater than 2,5 times the thickness of the plate, for the support thus given $C = 7900$ where the plates are not exposed to flame and $C = 6900$ where they are exposed to flame. The pitch is to be reckoned from the commencement of the curvature.

3. For portions of plate where the stays are irregularly pitched d^2 is to be used instead of $a^2 + b^2$, d being the diameter of the largest circle which can be drawn passing through not less than three points of support, viz., the centres of stays or the commencement of the curvature of flanging whichever is applicable. In this case C is to be taken as the mean of the values appropriate for the points of support.

4. For the tops and sides of combustion chambers the distance between the rows of stays nearest to the back tube plate or the back plate respectively and the commencement of curvature of these plates at their flanges is not to be greater than a.

5. The stays of the combustion chambers are to be so placed that the seams of the plates can be caulked without removing the stay nuts.

6. For the tops of combustion chambers where they are joined to the sides by curved portions, if the outer radius of the curved portion is less than half the allowable distance between the girders, the distance between the first girder and the inner surface of the side plate is not to exceed the allowable distance between the girders. If the radius of the curved portion is greater than half the allowable distance between the girders, the width of the flat portion measured from the centre of the girder is not to be more than half the allowable distance between the girders.

7. Where portions of plate are supported by stays secured in different ways the value of C to be taken is the mean of the values appropriate to the method of securing the supporting stays.

8. Where the plates are supported by stays passing through them and are fitted with nuts inside and washers and nuts outside, the diameter of the washers being at least 3,5 times that of the stay, and their thickness at least two-thirds of that of the plate but not greater than that of the plate :—

$$WP = \frac{7200}{a^2 + b^2}[(t-0,8)^2 + 0,15\ t_w^2]$$

9. Where the washers have a diameter of at least two-thirds of the pitch of the stays and a thickness of at least two-thirds of the thickness of the plate but not greater than that of the plate and are riveted to the plate in an efficient manner :—

$$WP = \frac{7200}{a^2 + b^2}[(t-0,8)^2 + 0,35\ t_w^2]$$

10. Where the plate is stiffened by strips at least two-thirds of the pitch of the stays in breadth and having a thickness at least two-thirds of that of the plate but not greater than that of the plate and are riveted to the plate in an efficient manner :—

$$WP = \frac{7200}{a^2 + b^2}[(t-0,8)^2 + 0,55\ t_w^2]$$

11. Where the plates are fitted with doubling plates having a thickness of at least two-thirds of that of the plate but not greater than that of the plate and are riveted to them :—

$$WP = \frac{7200}{a^2 + b^2}[(t-0,8)^2 + 0,85\ t_w^2]$$

12. For the portions of tube plates in the nests of tubes :—

$$WP = \frac{C\ (t-0,8)^2}{p^2}$$

where t is the thickness of the tube plate in millimetres,

p is the mean pitch in millimetres of the stay tubes supporting any portions of the plate (being the sum of the four sides of the quadrilateral divided by 4),

$C = 2740$ where the stay tubes are screwed and expanded into the plate and nuts are not fitted,

$C = 3530$ where the stay tubes are screwed and expanded into the plates and fitted with nuts.

13. For the wide water spaces of front tube plates between the nests of tubes and between the wing rows of tubes and the shell :—

$$WP = \frac{C[(t-0{,}8)^2 + 0{,}55t_w^2]}{a^2 + b^2}$$

where t is the thickness of the front tube plate in millimetres,

t_w is the thickness of the doubling plate, where so fitted in millimetres,

a is the horizontal pitch of stay tubes in millimetres measured across the wide water space,

b is the vertical pitch of stay tubes in the bounding rows, in millimetres, measured from centre to centre,

C = 3740 where the stay tubes are screwed and expanded into the tube plate and nuts are not fitted,

C = 5180 where the stay tubes are screwed and expanded into the tube plates, and nuts are fitted to each stay tube,

C = 4540 where the stay tubes are screwed and expanded into the tube plates, and nuts are fitted only to alternate stay tubes.

14. If steel of less strength than 41 kg. per mm². is used for flat plates, the working pressure allowed is to be correspondingly reduced.

Tube Plates under Compression.

Section 26. The pressure to be allowed on tube plates is to be calculated by the following formula, in which the compressive stress is taken at 9,8 kg. per mm². :—

$$WP = 1970 \times \frac{(D-d) \times t}{W \times D}$$

where t is the thickness of the tube plate in millimetres,

D is the horizontal distance apart of the tubes, centre to centre, in millimetres,

d is the internal diameter of the plain tubes in millimetres,

W is the width of combustion chamber in millimetres measured inside from tube plate to back chamber plate, or between tube plates in double-ended boilers with combustion chambers common to two opposite furnaces.

Tube Plates of Vertical Boilers.

Section 27. Where vertical boilers have a nest or nests of horizontal tubes so that there is direct tension on the tube plates due to the vertical load on the boiler ends or to their acting as horizontal ties across the shell, the thickness of the tube plates and the spacing of the tubes are to be such that the section of metal taking the load is sufficient to keep the stress within that allowed on the shell plates.

Further, each alternate tube in the outer vertical rows of tubes is to be a stay tube. The tube plates between the stay tubes are to be in accordance with the rules for tube plates as in **Section 25, clause 12,** and in addition

$$WP = \frac{(t-1{,}6) \times S \times (p-d) \times 100}{2{,}03 \times D \times p}$$

where S is the minimum tensile strength of the steel plate in kilogrammes per mm²,

t is the thickness of the tube plate in millimetres,

D is twice the radial distance of the centre of the outer row of tube holes from the axis of the shell in millimetres,

p is the vertical pitch of tubes in millimetres,

d is the diameter of the tube holes in millimetres.

Girders.

Section 28. For girders supporting the tops of combustion chambers the following formula is to be used :—

$$WP = \frac{C \times d^2 \times t}{(L-P) \times D \times L} \times \frac{S}{44}$$

where d is the depth of the girder at centres in millimetres ;

t is the thickness of the girder at centre, where this is a forging, or the sum of the thicknesses of the plates where the girder is made of two plates, measured in millimetres ;

L is the length of the girder in millimetres, measured between the tube plate and back chamber plate inside, or between tube plates in chambers common to two opposite furnaces ;

P is the pitch of stays supported by the girder, in millimetres ;

D is the distance apart of the girders, centre to centre, in millimetres ;

S is the minimum tensile strength of the steel plates forming the girder, in kilogrammes per mm². In the case of forged girders S is to be taken as 38 for iron and 44 for steel ;

C is a coefficient as follows :—

$$C = \frac{n}{n+1} \times 1110,$$

where the number of stays in each girder is odd,

$$= \frac{n+1}{n+2} \times 1110,$$

where the number of stays in each girder is even, n being the number of stays to each girder.

Stays.

Section 29. 1. For screw stays with threads not coarser than 9 threads per 25,4 mm., made of steel or of special wrought iron tested to the requirements of the Rules (*see* **Section 8** of the **Rules for the Quality and Testing of Materials**), the following formula is to be used, but in no case is the stress to exceed 6,33 kg. per mm². :—

$$WP = \frac{(d - 6{,}8)^2 \times 580}{a}$$

where d is the diameter of the stay over the thread in millimetres,

a is the area in square millimetres supported by one stay.

2. For steel longitudinal stays with threads not coarser than 6 threads per 25,4 mm. the working pressure is to be calculated from the following formula, but in no case is the stress to exceed 7,73 kg. per mm². where steel of a minimum tensile strength of 44 kg. per mm². is used :—

$$WP = \frac{(d - 8{,}6)^2 \times 670}{a} \times \frac{S}{44}$$

where d is the diameter of the stay over the thread in millimetres,

a is the area in square millimetres supported by one stay,

S is the minimum tensile strength of the steel in kilogrammes per mm².

3. In cases where longitudinal stays are made with enlarged ends and the body of the stay is smaller in diameter than at the bottom of the thread, and in cases where coarser threads than 6 per 25,4 mm. are used the working pressure is to be calculated from the following formula :—

$$WP = \frac{(d^1 - 3{,}2)^2 \times 670}{a} \times \frac{S}{44}$$

where d^1 is the diameter of the stay at the bottom of the thread or at the smallest part of the body.

Boiler Tubes, Plain and Stay.

Section 30. 1. Where smoke tubes are made of steel, the material is to comply with the requirements of **Section 16** of the **Rules for Quality and Testing of Materials.**

2. (*a*) The tolerance in thickness shall be 10 per cent below and 10 per cent above the specified thickness.

(*b*) The external diameter of the tubes, measured at any point, shall be within the following tolerances of the diameter ordered.

For tubes under 64 mm. outside diameter :—

+ 0,4 mm.
− 0,8 mm.

For tubes 64 mm. outside diameter and larger :—

± 1 per cent.

3. The following table gives the working pressures permissible with plain boiler tubes of standard thicknesses, whether of lapwelded wrought iron or of lapwelded or seamless mild steel :—

Outside Diameter of tube in millimetres.	Standard thicknesses in millimetres.				Working pressures in kilogrammes per cm².			
	A	B	C	D	A	B	C	D
51		3,00	3,25	3,65		11	15	21
57	3,00	3,25	3,65	4,00	10	13,5	18	22
63,5	3,00	3,25	3,65	4,00	9	12,5	16	21
70	3,00	3,25	3,65	4,00	8	11	15	19,5
76	3,25	3,65	4,00	4,5	10	13,5	17,5	21
82,5	3,25	3,65	4,00	4,5	9	12,5	16	19,5
89	3,25	3,65	4,00	4,5	8,5	11,5	15	18

4. On stay tubes, whether of wrought iron or of steel, a working stress of 5,27 kg. per mm². of the net sectional area at the bottom of the thread is allowed.

5. The minimum thickness of stay tubes measured under the threads is to be 6 mm. for marginal stay tubes and 5 mm. for other stay tubes.

6. Stay tubes are to be screwed at both ends with continuous threads, and the holes in the tube plates are to be tapped with continuous threads. The pitch of the thread is not to be finer than 10 threads per 25,4 mm. It is desirable however that they should be screwed to the standard 9 threads per 25,4 mm. The stay tubes are to be expanded by roller expanders and not made tight by caulking only.

7. Nuts are not to be fitted to stay tubes at the combustion chamber end.

8. If stay tubes are increased in thickness at the screwed ends so that the thickness at the bottom of thread is practically the same as in the body of the tube, the thickening is to be attained by upsetting and not by any welding process, and the tubes are to be annealed after the upsetting.

Dished Plates without Stays.

Section 31. 1. For ends of steam chests, crowns of vertical boilers or other plates which are dished outwards to partial spherical form and not fitted with stays the following formula is to be used :—

$$WP = \frac{21{,}4 \times S\,(t - 0{,}8)}{R}$$

WP is the working pressure in kilogrammes per cm².,

t is the thickness in millimetres,

R is the inner radius of curvature of the end in millimetres which is not to exceed the diameter of shell,

S the minimum tensile strength of plates in kilogrammes per mm².

The inside radius of curvature at the flange connecting the end to the cylindrical shell is not to be less than 4 times the thickness of the end plate and in no case less than 64 mm.

2. Where the end has a manhole in it 3 mm. is to be added to the thickness of plate.

If the plate at the manhole is stiffened by flanging, the total depth of the flange from the outer surface in millimetres is to be at least

$$= \sqrt{t \times w}$$

t is the thickness of plate in millimetres,

w is the minor axis of the hole in millimetres.

3. Where the end or crown is a complete hemisphere without stays or other supports, and is made in more than one plate, the working pressure to be allowed is given by the following formula :—

$$WP = \frac{(t - 1{,}6)\,S \times J}{C \times R}$$

where t is the thickness of the plates in millimetres,

S is the minimum tensile strength of the steel plates in kilogrammes per mm².,

J is the strength of riveted joint per cent of the solid plate,

R is the inner radius of curvature in millimetres,

C is a coefficient which for treble riveting is 1,98, for double riveting is 2,03, and for single riveting is 2,31.

WATER TUBE BOILERS.

Section 32. 1. **General.**—Water tube boilers are, as regards construction, and the quality and tests of the material used in their construction, to comply with the general **Rules for Cylindrical Boilers,** except as hereinafter specified ; and they are to be so designed as to ensure water circulation over every part of the surfaces exposed to flame when working under service conditions.

2. **Water Gauges.**—The position of the glass water gauges of boilers in which the tubes are entirely drowned when cold is to be such that water is just showing in the glass when the water level in the steam drum is just above the top of the uppermost tubes when the boiler is cold. In boilers, the tubes of which are not entirely drowned when cold, the glass water gauges are to be placed, to the Surveyor's satisfaction, in the positions which have been found by experience to indicate satisfactorily that the water content is sufficient for safety when the boiler is worked under all service conditions.

3. **Longitudinal Joints.**—The longitudinal joints of the cylindrical drums of water tube boilers, the internal diameters of which are less than 100 times the thickness of the plating at the joints, are not to be of ordinary riveted lapped type, but are to be such as to maintain internal circularity of section.

4. **Inclination of Water Tubes.**—The tubes which connect the drums or headers, and are the means for circulating the water when generating steam, are to be set at an inclination of not less than 15 degrees from the horizontal, but in the case of boilers where each tube is in series with one or more tubes so as to form a continuous run, the inclination need not exceed 5 degrees.

5. **Deposit Receptacles.**—It is desirable that provision should be made in the design so that solid matter in the water can be deposited automatically without danger arising from such matter collecting on parts exposed to heat.

6. **Protection of Steam Drum.**—Where the bottom of the steam drum is exposed to radiation from the fire, or to the impact of hot gases, and it is not protected by the tubes, a shield of good refractory material whose conductivity is low is to be fitted, or the tube plate is to be suitably thinned at this part.

Construction of Water Tube Boilers.

Section 33. 1. **Tube Ends.**—All tubes are to be carefully drifted or roller expanded in the holes in the tube plates. They are to project through the neck or bearing part in the holes by at least 6 mm. They are to be secured

from drawing out at each end, and if this is done by bellmouthing only, the bellmouthing is to be $\frac{1}{32}$ of the external diameter plus 1,6 mm. That is, the increase of diameter at the outer end of the bellmouth for a tube of 25 mm. in diameter is to be 2,4 mm., for a 50 mm. tube 3,2 mm., and for a 75 mm. tube 4 mm.

2. **Tube Holes.**—(*a*) The tube holes in the tube plates of drums, pockets or headers are to be formed in such a way that the tubes can be effectively tightened in them. Where the tube ends are not normal to the tube plates, there is to be a neck or belt of parallel seating of at least 13 mm. in depth measured in a plane through the axis of the tube at the holes.

(*b*) Where the tubes are practically normal to their plates, this parallel seating is not to be less than 9,5 mm. in depth.

3. **Thinning of Tube Plates.**—Where the tube plates are reduced in thickness for the purpose of jointing either by lapping or by the fitting of butt straps, or in order to receive the drum end flanges, such reductions are to be gradual and carefully machined to size.

4. **Thickness of Tubes.**—(*a*) For pressures up to 17,5 kgs. per mm²., the minimum thickness of tubes is to be calculated by the following formulæ :—

For the two rows of tubes next the fire and round the gaps formed in the nests of tubes for the outflow of the hot gases from the fire :—

$$t = \frac{WP \times d}{390} + 1,8$$

For all other tubes, including superheater tubes :—

$$t = \frac{WP \times d}{530} + 1,8$$

(*b*) For pressures above 17,5 kgs. up to 45,5 kgs. per mm²., and a designed steam temperature not exceeding 400° C., the minimum thickness of the tubes is to be calculated by the following formulæ :—

For the two rows of tubes next the fire and round the gaps formed in the nests of tubes for the outflow of the hot gases from the fire :—

$$t = \frac{d}{1400}(WP + 28) + 2,3$$

For all other tubes, including superheater tubes :—

$$t = \frac{d}{1400}(WP + 28) + 1,5$$

where **WP** is the working pressure in kilogrammes per cm².,
d is the external diameter in millimetres,
t is the thickness in millimetres.

The maximum thickness of any tube is not to exceed 7,5 mm.

5. **Tube Plates.**—Where tube plates form portions of cylindrical drums, their thickness in way of the tube holes is to be calculated by the following formula :—

$$t = \frac{WP \times C \times D}{S \times J} + 3,2$$

$$\text{or } WP = \frac{(t - 3,2)\ S \times J}{C \times D}$$

where **D** is the internal diameter of the drum in millimetres,
t is the thickness of tube plates in millimetres,
S is the minimum tensile strength of the plate forming the drum in kilogrammes per mm².,
J is the percentage strength of the plate through the tube holes, viz. :— $\frac{p - d}{p} \times 100$,
p is the pitch of the tubes in millimetres on lines parallel with the axis of the drum,
d is the diameter of the tube holes in millimetres,
C = 2,1.

6. **Headers and Analogous Fittings.**—These may be of wrought or cast steel, or of such other material as may be approved. If wrought steel is used, the material is to comply with the **Rules for the Quality and Testing of Materials.** If cast steel is used, the material is to comply with the aforementioned **rules,** without fracture of the test piece, the internal radius of the bend being not greater than 25 mm.

7. **Flat Surfaces of Headers and Similar Parts.**—(*a*) Where flat surfaces of headers or similar parts are not pierced for tubes, the thickness of such parts is not to be less than that given by the following formula :—

$$t = b \times \sqrt{\frac{WP}{C}} + 2,4$$

$$\text{or } WP = \left(\frac{t - 2,4}{b}\right)^2 \times C$$

where t is the thickness in millimetres,
b is the breadth (in millimetres) of the flat surface measured from support to support inside,
C = 5830 for wrought steel,
C = 4600 for steel castings.

(*b*) The thickness of the headers at the tube holes in millimetres is not to be less than

$$t = 0,473 \times \sqrt{d} + 6,35$$

where d is the diameter of the hole in millimetres.

(*c*) The headers in way of the sighting doors are to be machined to give true and fair faces for the doors to joint upon. The thickness where machined may be as much as 2,4 mm. less than given by the above rule, but generally it is not to be less than 8 mm.

(*d*) The thickness of all headers which are exposed to radiation from the fire, or to the impact of hot gases, and which have only steam within them under service conditions, as is the case with superheaters, is to be 12,5 per cent. greater than that given by the above formula.

(*e*) The sighting hole doors are to be substantial, and capable of being removed and replaced from time to time without loss of efficiency or safety. Where they are held in place by bolts, the doors are to be so designed that they will not blow out in the case of the breakage of the bolt or otherwise.

(*f*) Every flange is to have a fillet with a radius not less than the thickness of the neck to which it is attached.

Boiler Mountings and Fittings for Water Tube Boilers.

Section 34. 1. **Safety Valves.**—(*a*) The safety valves are to be in number, area, design, and ordinary construction in agreement with **Section 21** of the **Rules for Cylindrical Boilers.**

(*b*) An approved type of safety valve of equally good and reliable design may be fitted in lieu of those described in the Rules.

2. **Waste Steam Pipe.**—The waste steam pipe and passages leading to it from the safety valves are to be in area of cross section not less than 1,1 times the combined area of the valves as given by the above formula.

3. **Accumulation Tests.**—Tests for accumulation of pressure are to be carried out with the stop valve closed and under full firing conditions for as long a time as the water supply in the boiler permits, but in no case need they exceed 7 minutes in duration. The accumulation is not to exceed 10 per cent of the working pressure.

4. **Stop Valves.**—Where two or more boilers are connected together, stop valves of self-closing or non-return types are to be fitted.

5. **Water Gauges.**—There are to be at least two water gauges to each boiler, fitted in such a way as to be quite independent of each other. One of them is to be a glass water gauge, while the other may be an equivalent; but where water and steam drums exceeding 3,95 m. in length are fitted athwartship a glass water gauge is to be fitted at or near each end of the drum.

6. **Feed Water Fittings.**—(*a*) Each boiler is to be fitted with at least two distinct and independent feed systems, each with its own check valve attached direct to the boiler. At least one of these systems is to be fitted with an approved apparatus whereby the supply is controlled automatically.

(*b*) The feed check valves are to be fitted with efficient gearing, whereby they can be satisfactorily worked from the stokehold floor, or other convenient position.

7. **Manholes.**—In all the drums, manholes are to be provided of such size as to permit of access for internal examination, and for the satisfactory fitting of all the tubes in place.

8. **Mountings and Fittings.**—Those not referred to in this Section are to be in accordance with **Sections 18, 19, 20 and 22, of the Rules for Cylindrical Boilers.**

Tubes for Water Tube Boilers.

Section 35. 1.—All tubes subject to internal pressure are to be solid drawn and made of steel produced by an open-hearth process, acid or basic, the ultimate tensile strength of which does not exceed 44 kg. per mm^2. and the elongation of which is not to be less than 30 per cent. on a Standard Test Piece C (British Engineering Standards Association Test Piece F), when in the billet or bar form, and is to be certified as such by the makers of the steel and of the tubes.

2. All tubes under 38 mm. external diameter are to be cold finished; these, and all other cold-drawn tubes, are to be satisfactorily annealed before examination.

3. All tubes are to be free from defects, both within and without.

Tests of Tubes for Water Tube Boilers.

Section 36. 1.—All tubes up to 3,25 mm. in thickness are to be capable of being flattened by hammering when cold until the inner surfaces are not further apart than 1,6 mm. For those over 3,25 mm., and not exceeding 4,9 mm., the maximum distance apart is to be 5,5 mm.; for those over 4,9 mm., and not exceeding 6,4 mm., the maximum distance apart is to be 9,5 mm.; and for those whose thickness exceeds 6,4 mm., the maximum is to be 14,3 mm. In all cases after undergoing such tests there are not to be any signs of cracking or other fracture.

2. All tubes when cold are to be able to withstand, without cracking, an enlargement of diameter at both ends by means of roller expanders, or by drifts to the extent of :—

Thickness of Tubes.	Enlargement of Diameters at Ends by means of	
	Roller Expanders.	Drifts.
Up to 3,25 mm.	12,5 per cent.	9,5 per cent.
Above 3,25 mm. & up to 4,9 mm.	9,5 per cent.	7,0 per cent.
Above 4,9 mm.	6,5 per cent.	5,5 per cent.

3. (*a*) Tubes should be presented for test in batches of 100 each. Two tubes are to be selected indiscriminately from each of at least two batches, and one from each of any remaining batches. Each tube so selected is to be subjected to the above expanding tests, and one tube from each batch, which may be a tube that has sustained the expansion test, is also to be flattened cold to the extent specified in **clause 1** at three different parts of its length, of which one position is to be at or near the middle of the tube, and the flattened portions are to be in three different planes. The tubes are to pass these tests without signs of cracking.

(*b*) Should one of the selected tubes fail to withstand either of these tests, two further tubes are to be selected from the batch and be subjected to both the prescribed tests. If further failure occurs the particular batch of tubes is to be rejected as unsatisfactory.

4. (*a*) Every tube is to be tested at the Tube Maker's Works by hydraulic pressure to not less than 70 kg. per cm^2.

(*b*) Downcomer tubes are to be tested as required for steam pipes.

5. The manufacturer's certificate of the results of the foregoing tests may, at the discretion of the Surveyor, be accepted provided each tube is delivered with 25 mm. in excess of the finished length, which excess is to be partly severed for flattening to the extent prescribed in **clause 1.**

6. Every tube delivered is to be straight (unless otherwise specified) and is to be practically concentric throughout its length. The tolerance or deviation from the specified thickness is to be within the following limits :—

(*a*) **Cold Finished Tubes.**—The tolerance in thickness shall be 5 per cent below and 10 per cent above the specified thickness.

(*b*) **Hot Finished Tubes.**—The thickness of the tubes shall be within the following tolerances, measured at any point :—

From 38 mm. up to and including 63 mm. ... ... { − 7½ per cent. + 17½ „ „

Over 63 mm. up to and including 115 mm. ... ... { − 5 per cent. + 15 „ „

Over 115 mm. ... ... { − 7½ per cent. + 17½ „ „

The tolerances in external diameter from those specified are to be as follows :—

(*a*) **Cold Finished Tubes.**—The external diameter of the tubes, measured at any point, shall be not greater than that specified, but may be less by a maximum of 1 per cent.

(*b*) **Hot Finished Tubes.**—The external diameter of the tubes, measured at any point, shall be within the following tolerances of the diameter ordered :—

For tubes from 38 mm. but below 63 mm. ... ... { 0·4 mm. 0·8 mm.

For tubes 63 mm. diameter and over... ± 1 per cent.

Spare Gear.

Section 37. The articles of spare gear mentioned in the following list will be required to be carried in all vessels fitted with steam Reciprocating Engines classed in the Society's Register Book, viz. :—

* For a single-screw ship a propeller, or two blades with studs and nuts for one blade. The propeller or blades may be of cast iron, except for ships having the notation "Strengthened for Navigation in Ice."

1 complete bottom end bearing.

1 complete top end bearing.

* 1 set of metallic packing complete for each size of main piston rod.

* 1 set of coupling bolts of each size used.

1 set of pads of each hand for one face of Michell thrust block.

1 set of feed and bilge pump valves and seats where these pumps are worked by the main engines.

1 set of valves of each size used for the liquid end of each independent pump.

1 set of air pump valves.

1 set of circulating pump valves.

1 valve lid for main feed check for one boiler.
* 1 impeller shaft for main circulating pump.
1 set of rings for H.P. piston.
1 set of rings for H.P. piston valve.
1 valve of each size with springs and rollers where poppet valves are used on the main engines.
12 boiler tube stoppers complete.
A set of fire bars for one furnace.
1 set of oil fuel burner nozzles complete with atomisers, etc., for one boiler.
A quantity of assorted bolts, studs and nuts. Steel bars and plates of various sizes.

In vessels classed in the Society's Register Book fitted with Steam Turbine Engines the articles of spare gear mentioned in the following list will be required to be carried, viz. :—

* For a single screw ship a propeller, or two blades with studs and nuts for one blade. The propeller or blades may be of cast iron.
1 set of coupling bolts of each size used.
* 1 complete bearing bush of each size used for main gear wheel shaft.
1 complete bearing bush of each size used for rotor shaft.
1 complete bearing bush of each size used for pinion shaft.
1 half set of packing rings or segments for each gland of rotor shafts so fitted, and half the number of springs fitted.
2 ordinary thrust shoes for main thrust block or sufficient pads for one face of Michell Type of main thrust block of each hand.
Turbine thrust and adjusting bushes with rings complete (or one set of pads of each hand for Michell type) for one turbine of each size fitted.
1 set of liners for adjusting block of different thicknesses.
1 set of valves of each size used for the liquid end of each pump.
1 valve lid for main feed check for one boiler.
* 1 impeller shaft for main circulating pump.
12 boiler tube stoppers complete.
1 set of fire bars for one furnace.
1 set of oil fuel burner nozzles complete with atomisers, etc., for one boiler.
A quantity of assorted studs, bolts and nuts. Steel bars and plates of various sizes.

PERIODICAL SURVEYS.

Section 38. The periodical surveys of the machinery and boilers are detailed on pages 19 to 23 under **Periodical Surveys of Main and Auxiliary Engines and Boilers, and Electrical Equipment.**

* Not required for vessels engaged on short voyages.

By order of the Committee,
MALCOLM K. SCOTT,
Secretary.

71, Fenchurch Street, London, E.C.3.
8th April, 1937.

RULES FOR THE CONSTRUCTION AND SURVEY OF PETROL AND PARAFFIN ENGINES.

GENERAL.

Section 1. In vessels propelled by Petrol or Paraffin Engines, the Rules as regards Machinery are the same as those relating to steam engines so far as regards the testing of material used in their construction and the fitting of sea connections, discharge pipes, shafting, stern tubes and propellers.

CONSTRUCTION.

Section 2. 1. The following points are to be observed in connection with the design of the engines.

2. The shaft bearings, connecting rod brasses, the valve gear, the inlet and exhaust valves are to be easily accessible.

3. The reversing gear and clutch are to be strongly constructed and easily accessible for examination and adjustment.

4. In engines of above 60 B.H.P. which are not reversible and which are manœuvred by clutch, a governor or other arrangement is to be fitted to prevent racing of the engine when de-clutched.

5. In vessels intended for open sea service and fitted with engines of 350 B.H.P. and over, in which the lubricating oil is circulated under pressure, a spare oil pump is to be supplied with all connections ready for immediate use, and two independent means are to be arranged for circulating water through the oil cooler, where this is fitted.

6. If the engines are of the closed-in type, they are to be so fitted that the contained lubricating oil can be drained when necessary, and in wood vessels an easily drained metal or metal-lined tray is to be fitted to prevent leakage of either fuel oil or of lubricating oil from saturating the wood-work.

7. Carburettors, where petrol is used, and vaporizers, where paraffin is used, are to be so designed that when the engine is stopped the fuel supply is automatically shut off. If an overflow is provided in the carburettor or vaporizer, a gauze covered tray with means of draining is to be fitted to prevent the fuel from flowing into the bilges.

Strong metallic gauze diaphragms are to be fitted either between the carburettor (or vaporizer) and cylinders, or at the air inlets.

8. If the ignition is electric, either by magneto or by coil and accumulator, all electric leads are to be well insulated and suitably protected from mechanical injury. The leads are not to be placed where they may be brought into contact with oil or petrol.

The commutator is to be enclosed, and the sparking coils are not to be placed where they can be exposed to explosive vapour.

9. In paraffin engines where lamps are used for ignition or for vaporizing, these lamps are to be fixed by some suitable bracket, and the flame enclosed when in use.

10. The water circulating pump sea suction is to have a cock or valve on the vessel's skin placed on the turn of the bilge in an easily accessible position, and the circulating pipe is to be provided with an efficient strainer which can be cleared inside the vessel. The discharge overboard is to be fitted with a cock or valve on the vessel's skin if it is situated under or near the load line of the vessel.

11. (*a*) The pumping arrangements are to be the same as would be required for steam vessels of similar size and power, with the exception that a bilge suction need not be fitted to the main engine water circulating pump. In the cases of vessels fitted with water ballast, the water ballast pump is to be fitted with a direct suction from the engine room bilges.

(*b*) In open launches and in auxiliary vessels not greater than 24,5 m. Rule length, power pump suctions may be dispensed with, provided manual pumps be fitted for the purpose of efficiently draining each compartment which is situated below the upper deck.

The manual pumps are to be workable from the upper deck, and the tail pipes are to be fitted with suction roses.

The inside diameters of the tail pipes of manual pumps are to be 6 mm. for every 7,5 m. of the Rule length plus 25 mm. No tail pipe is, however, to be less than 32 mm. or need be more than 65 mm. bore, except in vessels not greater than 7,5 m. Rule length, where they may be 25 mm. bore.

The diameters of the barrels of manual pumps are to be twice the diameter of their tail pipes.

12. Where the cylinder liners are made of hard close grained cast iron of plain cylindrical form, accurately turned on the outside as well as bored on the inside, so that their soundness can be ascertained by inspection, they need not be hydraulically tested by internal pressure. If, however, they are made of complicated form, the question of testing is to be submitted.

13. The water jackets of the cylinders, and the water passages of the cylinder covers and pistons are to be tested by hydraulic pressure to 2,1 kg. per cm². and are to be perfectly tight at that pressure.

14. The exhaust pipes and silencer are to be efficiently water cooled or lagged to prevent damage by heat, and if the exhaust is led overboard near the water-line, means are to be provided to prevent water from being syphoned back to the engine.

15. If compressed air receivers are fitted, they are to comply with the requirements of **Section 6 (Rules for Heavy Oil Engines)**.

16. The machinery is to be tried under full working conditions, the report stating the approximate speed of vessel, the number of revolutions of the engines at full power, both ahead and astern, and the lowest number of revolutions of the engines which can be maintained for manœuvring purposes.

RULES FOR DETERMINING SIZES OF SHAFTS.

Section 3. 1.—(*a*) The crank, intermediate and other shafts, if of ordinary mild steel having a tensile strength of 44-50 kg. per mm²., are to be of not less diameters than those given by the following formulæ.

(*b*) Where shafts are proposed to be made of special high tensile steel, their sizes should be submitted for consideration.

2. **Crank Shafts.**—The diameter of the crank shaft of the main engines is not to be less than that given by the following formula:—

$$\left.\begin{array}{l}\text{Diameter of}\\ \text{crank shaft}\\ \text{in millimetres}\end{array}\right\} = \sqrt[3]{D^2 \times (A\,S + B\,L)}$$

where **D** = diameter of cylinder in millimetres,

S = length of stroke in millimetres,

L = span of bearings adjacent to a crank measured from inner edge to inner edge in millimetres.

The values of **A** and **B** given in Table I. apply to engines in which there are bearings adjacent to each side of each crank. If there are two cranks between consecutive bearings the same Rules will apply, but **L** will be the span of bearings from inner edge to inner edge adjacent to the two cranks.

TABLE I.

4 Cycle Single Acting Engines.	2 Cycle Single Acting Engines.	For Smooth Water Service Values of		For Open Sea Service Values of	
		A	B	A	B
1,2,3 or 4 Cyls.	1 or 2 Cyls.	0,025	0,022	0,028	0,024
6 „	3 „	0,031	0,021	0,034	0,023
8 „	4 „	0,035	0,020	0,039	0,022
12 „	6 „	0,048	0,017	0,053	0,019

3. For engines of the aforementioned types driving auxiliary machinery, the diameters of the crank shafts may be 5 per cent less than given by the foregoing formula applying to main engines for open sea service.

4. **Crank Webs.**—In solid forged shafts the breadth of the webs should not be less than 1,33, and the thickness not less than 0,56 times the diameter of the shaft as found by the foregoing formula or if these proportions are departed from, the webs are to be of equivalent strength.

5. **Intermediate Shafts.**—The diameter of the intermediate shafts is not to be less than that given by the following formula :—

$$\text{Diameter of intermediate shaft in millimetres} = C\sqrt[3]{D^2 \times S}$$

where D = diameter of cylinder in millimetres,

S = length of stroke in millimetres,

C is a coefficient found from Table II. by interpolation from the values found for A :—

$$A = \frac{D^2 \times S \times 5760}{W \times d^2 \times R^2}$$

where D = diameter of cylinder, in millimetres,

S = length of stroke, in millimetres,

d = diameter of fly wheel, in millimetres,

R = revolutions of engines per minute,

W = total weight of fly wheel, in kilogrammes.

TABLE II.

FOR SMOOTH WATER SERVICE.				
4 Cycle Single Acting Engines.	2 Cycle Single Acting Engines.	Values of the Coefficient C where		
		A=0,0025	A=0,0050	A=0,0100
2 Cyl.	1 Cyl.	0,240	0,250	0,256
3 „	—	0,255	0,264	0,270
4 „	2 „	0,272	0,277	0,282
6 „	3 „	0,298	0,301	0,304
8 „	4 „	0,322	0,324	0,325
12 „	6 „	0,363	0,364	0,365
FOR OPEN SEA SERVICE.				
4 Cycle Single Acting Engines.	2 Cycle Single Acting Engines.	Values of the Coefficient C where		
		A=0,0025	A=0,0050	A=0,0100
2 Cyl.	1 Cyl.	0,252	0,262	0,269
3 „	—	0,269	0,276	0,283
4 „	2 „	0,286	0,291	0,296
6 „	3 „	0,313	0,316	0,319
8 „	4 „	0,338	0,340	0,341
12 „	6 „	0,382	0,382	0,383

6. If a separate fly wheel shaft is fitted its diameter is to be at least equal to that of the crank shaft.

7. **Thrust Shafts.**—The diameter at the collars of thrust shafts transmitting torque is not to be less than 1,05 times that required for the intermediate shaft. Thrust shafts may be tapered down outside the collars to the diameter required for the intermediate shaft.

8. **Tube Shafts** (shafts passing through stern tubes but not carrying the screw propellers).—The diameter of the tube shaft is not to be less than 1,05 times that required for the intermediate shaft, and any part of the shaft within the tube which may be exposed to sea water is not to be less than 1,075 times that required for the intermediate shaft.

9. **Screw Shafts** (shafts carrying the screw propellers). —(*a*) The diameter of the screw shaft is not to be less than that given by the following formula :—

$$\text{Diameter of screw shaft in millimetres} = d + \frac{P}{C}$$

where d is the diameter required for the intermediate shaft, in millimetres,

P is the diameter of the propeller, in millimetres,

C = 144 when the shaft is fitted with a continuous liner, or

C = 100 when the shaft is not fitted with a continuous liner.

(*b*) Screw shafts which run in stern tubes may have the end forward of the stern gland tapered down to a diameter at the coupling flange, of 1,05 times d.

10. **Bronze Liners on Shafts.**—(*a*) The thickness of liners fitted on screw shafts, or on tube shafts, in way of the bushes, is not to be less than that given by the following formulæ :—

$$t = \frac{d + 235}{32}$$

where t is the thickness of the liner in millimetres,

d is the diameter required for the screw or tube shaft under the liner, in millimetres.

(*b*) The thickness of a continuous liner between the bushes is not to be less than 0,75t.

(*c*) Continuous liners should be cast in one piece or, if made of two or more lengths, the junctions of the separate pieces are to be made by fusion through the whole thickness of the liner.

(*d*) Liners are to be carefully shrunk on, or forced on to the shafts by hydraulic pressure. Pins are not to be used to secure the liners.

(*e*) If the liner does not fit tightly between the bearings in the stern tube, the space between the shaft and the liner is to be charged or forced with a plastic material insoluble in water and non-corrosive.

(*f*) Effective means are to be provided for preventing water from having access to the shaft at the part between the after end of the liner and the propeller boss.

11. **Stern Bush.**—The length of the bearing in the stern bush next to and supporting the propeller is not to be less than 4 times the diameter required for the screw shaft under the liner.

12. **Couplings.**—(*a*) The diameter of the coupling bolts at the joining faces of the couplings is not to be less than that given by the following formula :—

$$\text{Diameter of coupling bolts, in millimetres...} = \sqrt{\frac{d^3}{3{,}5 \times n \times r}}$$

where d is the diameter required for the intermediate shafts, in millimetres,

n is the number of bolts in the coupling,

r is the radius of the pitch circle of the bolts, in millimetres.

(*b*) The thickness of the coupling flanges at the pitch circle of the bolt holes is not to be less than the diameter of the coupling bolts, at the face of the coupling. The thickness of the screw shaft coupling flange is not to be less than 0,25 of the diameter required for the intermediate shaft.

(*c*) The radius of curvature at the fillet where the flange starts from the shaft should not be less than 0,125 times the diameter of the shaft adjacent to the flange.

(*d*) Where couplings are separate from the shafts, provision is to be made to resist the astern pull.

13. **Bronze Propellers.**—Where bronze is used for propellers or propeller blades, it is to comply with the requirements of **Section 11** of the **Rules for Quality and Testing of Materials.**

71, Fenchurch Street, London, E.C.3.
23*rd April*, 1936.

PETROL AND PARAFFIN TANKS AND CONNECTIONS.

Section 4. 1. All fuel tanks and their fittings are to be in accordance with **Section 20** (**Rules for Steel Ships**), as far as applicable.

2. Strong and readily removable metallic gauze diaphragms are to be fitted at all openings on petrol tanks.

3. Glass gauges are not to be fitted to fuel tanks containing either petrol or paraffin.

4. Filling pipes are to be carried through the deck so that the gas displaced from the tanks has free escape to the atmosphere.

5. Separate fuel tanks are to be provided with metal or metal-lined trays to prevent any possible leakage from them flowing into the bilges, or saturating woodwork. Arrangements are to be provided for emptying the tanks and draining the trays beneath them. For petrol tanks the trays are to be fitted with drains leading overboard where possible, or they are to be gauze-covered trays with means for draining them.

6. All petrol or paraffin fuel pipes are to be of annealed seamless copper with flexible bends. Their joints are to be conical, metal to metal. A cock or valve is to be fitted at each end of the pipe conveying the fuel from the tank to the carburettor or vaporizer. The fuel pipes are to be led in positions where they are protected from mechanical injury and can be exposed to view throughout their whole length.

7. The engine room and the compartment in which the fuel tanks are situated, are to be efficiently ventilated.

8. An approved fire extinguishing apparatus is to be supplied.

PERIODICAL SURVEYS.

Section 5. The periodical surveys of the machinery are detailed on pages 21 and 22 under "**Petrol, Paraffin, and Heavy Oil Engines.**"

By order of the Committee,
MALCOLM K. SCOTT,
Secretary.

RULES FOR THE CONSTRUCTION AND SURVEY OF HEAVY OIL ENGINES AND THEIR AUXILIARIES.

GENERAL.

Section 1. In vessels propelled by Heavy Oil Engines, the Rules as regards machinery are the same as those relating to steam engines, so far as regards the testing of material used in their construction and the fitting of sea connections, discharge pipes, shafting, stern tubes, and propellers.

CONSTRUCTION.

Section 2. 1. In vessels built under Special Survey and fitted with Heavy Oil Engines, the engines are also to be constructed under Special Survey.

2. In cases of Heavy Oil Engines being built under Special Survey, the distinguishing mark ✠ will be noted in Red, thus :—✠LMC or ✠NE.

3. In order to facilitate the inspection, the plans of the machinery are to be examined by the Surveyors, and the dimensions of the shafts are to be submitted for approval.

4. The Surveyors are to examine the materials and workmanship from the commencement of the work until the final test of the machinery under full power working conditions ; any defects are to be pointed out as early as possible.

5. Any novelty in the construction of the machinery is to be reported to the Committee and submitted for approval.

6. The auxiliary engines used for air compressing, working dynamos and ballast, or other, pumps, are also to be surveyed during construction.

SINGLE ACTING ENGINES.

Rules for Determining Sizes of Shafts.

Section 3. 1.—(*a*) The crank, intermediate and other shafts, if of ordinary mild steel having a tensile breaking strength of 44–50 kg. per mm², are to be of not less diameters than those given by the following formulæ.

(*b*) Where shafts are proposed to be made of special high tensile steel, their sizes should be submitted for consideration.

2. **Crank Shafts.**—The diameter of the crank shaft of the main engines is not to be less than that given by the following formula :—

$$\left.\begin{array}{l}\text{Diameter of crank-}\\ \text{shaft in milli-}\\ \text{metres}\end{array}\right\} = \sqrt[3]{\frac{}{D^2 \times (AS + BL)}}$$

where **D** = diameter of cylinder, in millimetres,

S = length of stroke, in millimetres,

L = span of bearings adjacent to a crank, measured from inner edge to inner edge, in millimetres.

A and **B** are coefficients dependent upon the designed maximum and mean indicated pressures and are found from Table I.

Where the designed maximum pressure and/or the designed mean indicated pressure are intermediate between the standard pressures given in Table I., the coefficients **A** and **B** are to be found by interpolation between those given in the Table.

TABLE I. FOR CRANK SHAFTS OF SINGLE ACTING ENGINES.

4 Cycle Single Acting Engines. — Number of Cylinders.	2 Cycle Single Acting Engines. — Number of Cylinders.	Values of Coefficients.									
		Maximum Pressure 21 kg. per cm².				Maximum Pressure 28 kg. per cm².					
		M.I.P. 2,8 kg. per cm².		M.I.P. 4,2 kg. per cm².		M.I.P. 2,8 kg. per cm².		M.I.P. 4,2 kg. per cm².		M.I.P. 5,6 kg. per cm².	
		A	B	A	B	A	B	A	B	A	B
1, 2, 3 or 4	1 or 2	0,017	0,031	0,026	0,031	0,013	0,062	0,025	0,058	0,036	0,054
5 or 6	3	0,027	0,028	0,036	0,028	0,025	0,058	0,038	0,054	0,050	0,050
7 or 8	4	0,028	0,028	0,040	0,028	0,026	0,058	0,040	0,054	0,061	0,048
9 or 10	5	0,030	0,027	0,044	0,027	0,028	0,056	0,048	0,051	0,068	0,047
11 or 12	6	0,031	0,027	0,045	0,027	0,027	0,058	0,051	0,051	0,070	0,046
—	7	0,033	0,027	0,049	0,027	0,034	0,054	0,058	0,049	0,076	0,045
—	8	0,036	0,027	0,053	0,027	0,038	0,054	0,064	0,048	0,079	0,045
—	9	0,041	0,026	0,058	0,026	0,043	0,051	0,070	0,046	0,090	0,042
—	10	0,045	0,024	0,065	0,024	0,045	0,051	0,072	0,046	0,099	0,041
—	11	0,044	0,026	0,064	0,026	0,046	0,053	0,074	0,046	0,104	0,041
—	12	0,045	0,026	0,067	0,026	0,047	0,053	0,076	0,046	0,109	0,040
—	4 2 Firing together.	0,040	0,026	0,057	0,026	0,036	0,054	0,059	0,049	0,085	0,043
—	6 2 Firing together.	0,045	0,024	0,061	0,024	0,041	0,053	0,069	0,046	0,093	0,042
—	8 2 Firing together.	0,064	0,022	0,086	0,022	0,060	0,049	0,096	0,043	0,133	0,038
—	10 2 Firing together.	0,071	0,022	0,094	0,022	0,074	0,046	0,112	0,040	0,142	0,037
—	12 2 Firing together.	0,065	0,022	0,091	0,022	0,073	0,046	0,112	0,040	0,147	0,037

TABLE I.—*continued.* FOR CRANK SHAFTS OF SINGLE ACTING ENGINES.

4 Cycle Single Acting Engines. — Number of Cylinders.	2 Cycle Single Acting Engines. — Number of Cylinders.	Values of Coefficients. Maximum Pressure 35 to 50 kg. per cm². M.I.P. 2,8 kg. per cm². A	M.I.P. 2,8 kg. per cm². B	M.I.P. 4,2 kg. per cm². A	M.I.P. 4,2 kg. per cm². B	M.I.P. 5,6 kg. per cm². A	M.I.P. 5,6 kg. per cm². B	M.I.P. 7 kg. per cm². A	M.I.P. 7 kg. per cm². B	M.I.P. 8,4 kg. per cm². A	M.I.P. 8,4 kg. per cm². B	M.I.P. 9,8 kg. per cm². A	M.I.P. 9,8 kg. per cm². B	M.I.P. 11,2 kg. per cm². A	M.I.P. 11,2 kg. per cm². B
1, 2, 3 or 4	1 or 2	0,030	0,067	0,046	0,067	0,061	0,067	0,076	0,067	0,089	0,067	0,099	0,067	0,108	0,067
5 or 6	3	0,042	0,064	0,059	0,064	0,070	0,064	0,082	0,064	0,096	0,064	0,111	0,064	0,120	0,064
7 or 8	4	0,045	0,062	0,062	0,062	0,079	0,062	0,092	0,062	0,110	0,062	0,127	0,062	0,143	0,062
9 or 10	5	0,047	0,061	0,064	0,061	0,082	0,061	0,101	0,061	0,121	0,061	0,135	0,061	0,150	0,061
11 or 12	6	0,049	0,061	0,066	0,061	0,084	0,061	0,103	0,061	0,123	0,061	0,137	0,061	0,153	0,061
—	7	0,051	0,061	0,068	0,061	0,086	0,061	0,106	0,061	0,125	0,061	0,140	0,061	0,156	0,061
—	8	0,053	0,061	0,070	0,061	0,088	0,061	0,109	0,061	0,128	0,061	0,148	0,061	0,165	0,061
—	9	0,059	0,058	0,080	0,058	0,101	0,058	0,122	0,058	0,144	0,058	0,163	0,058	0,181	0,058
—	10	0,064	0,057	0,088	0,057	0,112	0,057	0,134	0,057	0,157	0,057	0,178	0,057	0,198	0,057
—	11	0,066	0,056	0,091	0,056	0,115	0,056	0,139	0,056	0,161	0,056	0,182	0,056	0,203	0,056
—	12	0,069	0,056	0,093	0,056	0,119	0,056	0,147	0,056	0,178	0,056	0,202	0,056	0,223	0,056
—	4 2 Firing together.	0,076	0,054	0,105	0,054	0,136	0,054	0,160	0,054	0,183	0,054	0,206	0,054	0,232	0,054
—	6 2 Firing together.	0,078	0,053	0,107	0,053	0,140	0,053	0,164	0,053	0,187	0,053	0,210	0,053	0,237	0,053
—	8 2 Firing together.	0,097	0,050	0,133	0,050	0,170	0,050	0,203	0,050	0,229	0,050	0,258	0,050	0,292	0,050
—	10 2 Firing together.	0,107	0,049	0,141	0,049	0,175	0,049	0,208	0,049	0,242	0,049	0,268	0,049	0,303	0,049
—	12 2 Firing together.	0,090	0,051	0,126	0,051	0,161	0,051	0,196	0,051	0,222	0,051	0,248	0,051	0,286	0,051

For heavy oil engines, with not more than three cylinders, driving auxiliary machinery the diameters of the crankshafts may be five per cent less than given by the foregoing formula.

3. **Crank Webs of Solid Forged Shafts.**—In solid forged shafts the breadth of the webs should not be less than 1,33 times and the thickness not less than 0,56 times the diameter of the shaft as found by the foregoing formula, or, if these proportions are departed from, the webs are to be of equivalent strength.

4. **Crank Webs of Built Shafts.**—(*a*) The dimensions of the crank webs of built shafts are not to be less than those given by the following formulæ :—

$$h = 0{,}625 \times d$$

$$t = \sqrt{\frac{0{,}12 \times d}{h}}$$

where h is the thickness of the web, measured parallel to the axis, in millimetres,

t is the thickness of metal around the eyeholes, measured radially, in millimetres,

d is the diameter required for the crank shaft, in millimetres.

(*b*) Crank webs are to be securely shrunk on the body pieces and crank pins, or to be forced on by hydraulic pressure. One or two keys or cylindrical dowels are to be fitted at the junction of the body pieces and webs.

The Committee will be prepared to give consideration to the circumstances of any special case.

5. **Intermediate Shafts.**—The diameter of the intermediate shafts is not to be less than that given by the formulæ :—

For engines having a maximum pressure under 25 kg. per cm². Diameter of intermediate shaft, in millimetres

$$= 25{,}4\, C \sqrt[3]{\frac{B.H.P.}{R}}$$

(Table II.)

For engines having a maximum pressure of 25 and under 35 kg. per cm². Diameter of intermediate shaft, in millimetres

$$= 25{,}4\, C \sqrt[3]{\frac{B.H.P.}{R}}$$

Table (III.)

For engines having a maximum pressure of 35 to 50 kg. per cm². Diameter of intermediate shaft, in millimetres

$$= 25{,}4\, C \sqrt[3]{\frac{B\,H.P.}{R}}$$

(Table IV.)

where **B.H.P.** = designed maximum brake horse power.

R = revolutions of engines per minute.

C is a coefficient found from Tables II. or III., by interpolation from the values found for **A**, or from Table IV. by interpolation from the values found for **A** and the piston speeds.

In using Tables II., III. and IV. the appropriate value of **A** is found thus :—

$$A = \frac{D^2 \times S \times 5760}{W \times d^2 \times R^2}$$

where **D** = diameter of cylinder, in millimetres,

S = length of stroke, in millimetres,

d = diameter of fly wheel, in millimetres,

R = revolutions of engines per minute,

W = total weight of fly wheel, in kilogrammes.

Where a fly wheel is not fitted, but where there are special balance weights at the crank webs, the value of **A** may be found from the formula :—

$$A = \frac{D^2 \times S \times 5760}{6{,}24 \times w \times r^2 \times R^2}$$

where **D** = diameter of cylinder, in millimetres,

S = length of stroke, in millimetres,

r = radius of gyration of balance weights, in millimetres,

R = revolutions of engines per minute,

w = total weight of balance weights, in kilogrammes.

Where a fly wheel and special balance weights are fitted, the value of **A** may be found from the formula :—

$$A = \frac{D^2 \times S \times 5760}{(6{,}24 \times wr^2 + Wd^2) \times R^2}$$

6. **Fly Wheel Shaft.**—The diameter of the fly wheel shaft is to be at least equal to that of the crank shaft.

7. **Thrust Shafts.**—The diameter at the collars of thrust shafts transmitting torque is not to be less than 1,05 times that required for the intermediate shaft. Thrust shafts may be tapered down outside the collars to the diameter required for the intermediate shaft.

8. **Tube Shafts** (Shafts passing through stern tubes but not carrying the screw propellers).—The diameter of the tube shaft is not to be less than 1,05 times that required for the intermediate shaft, and any part of the shaft within the tube which may be exposed to sea water is not to be less than 1,075 times that required for the intermediate shaft.

9. **Screw Shafts** (Shafts carrying the screw propellers).—(*a*) The diameter of the screw shaft is not to be less than that given by the following formula :—

$$\text{Diameter of screw shaft, in millimetres} = d + \frac{P}{C},$$

where d is the diameter required for the intermediate shafts, in millimetres,

P is the diameter of the propeller, in millimetres,

C = 144 when the shaft is fitted with a continuous liner, or

C = 100 when the shaft is not fitted with a continuous liner.

(*b*) Screw shafts which run in stern tubes may have the end forward of the stern gland tapered down to a diameter, at the coupling flange, of 1,05 times d.

10. **Bronze Liners on Shafts.**—(*a*) The thickness of liners fitted on screw shafts or on tube shafts, in way of the bushes, is not to be less than that given by the following formulæ :—

$$t = \frac{d + 235}{32}$$

where t is the thickness of the liner, in millimetres,

d is the diameter required for the screw or tube shaft under the liner, in millimetres.

(*b*) The thickness of a continuous liner between the bushes is not to be less than 0,75t.

(*c*) Continuous liners should be cast in one piece, or, if made of two or more lengths, the junctions of the separate pieces are to be made by fusion through the whole thickness of the liner.

(*d*) Liners are to be carefully shrunk on, or forced on to the shafts by hydraulic pressure. Pins are not to be used to secure the liners.

(*e*) If the liner does not fit tightly between the bearings in the stern tube, the space between the shaft and the liner is to be charged or forced with a plastic material insoluble in water and non-corrosive.

(*f*) Effective means are to be provided for preventing water from having access to the shaft at the part between the after end of the liner and the propeller boss.

11. **Stern Bush.**—The length of the bearing in the stern bush next to and supporting the propeller, is not to be less than 4 times the diameter required for the screw shaft under the liner.

12. **Couplings.**—(*a*) The diameter of the coupling bolts at the joining faces of the couplings is not to be less than that given by the following formula :—

$$\text{Diameter of coupling bolts, in millimetres...} = \sqrt{\frac{d^3}{3,5 \times n \times r}}$$

where d is the diameter required for the intermediate shafts, in millimetres,

n is the number of bolts in the coupling,

r is the radius of the pitch circle of the bolts, in millimetres.

(*b*) The thickness of the coupling flanges at the pitch circle of the bolt holes is not to be less than the diameter of the coupling bolts, at the face of the coupling. The thickness of the screw shaft coupling flange is not to be less than 0,25 of the diameter required for the intermediate shaft.

(*c*) The radius of the curvature at the fillet where the flange starts from the shaft, should not be less than 0,125 times the diameter of the shaft adjacent to the flange.

(*d*) Where couplings are separate from the shafts, provision is to be made to resist the astern pull.

13. **Bronze Propellers.**—Where bronze is used for propellers or propeller blades, it is to comply with the requirements of **Section 11** of the **Rules for Quality and Testing of Materials.**

TABLE II. FOR INTERMEDIATE SHAFTS OF SINGLE ACTING ENGINES.

MAXIMUM PRESSURE UNDER 25 KG. PER CM^2.

4 Cycle Single Acting Engines. — Number of Cylinders.	2 Cycle Single Acting Engines. — Number of Cylinders.	Values of Coefficient C where A = ·0015	A = ·0025	A = ·005	A = ·010	A = ·015	No Fly Wheel or Balance Weights.
1 or 2	1	4,26	4,48	5,02	5,92	—	—
3 or 4	2	4,17	4,20	4,25	4,38	4,55	5,96
5 or 6	3	4,15	4,17	4,20	4,26	4,35	4,90
7 or 8	4	4,10	4,13	4,16	4,24	4,32	4,77
9 or 10	5	4,07	4,07	4,09	4,14	4,18	4,34
11 or 12	6	4,06	4,06	4,06	4,08	4,10	4,18
—	7	4,05	4,05	4,05	4,06	4,06	4,09
—	8	4,04	4,04	4,04	4,04	4,04	4,04
—	9	4,03	4,03	4,03	4,03	4,03	4,03
—	10	4,03	4,03	4,03	4,03	4,03	4,03
—	11	4,02	4,02	4,02	4,02	4,02	4,02
—	12	4,02	4,02	4,02	4,02	4,02	4,02
—	4 2 Firing together.	4,13	4,20	4,38	4,67	4,87	5,85
—	6 2 Firing together.	4,12	4,19	4,32	4,50	4,63	5,13
—	8 2 Firing together.	4,10	4,15	4,24	4,36	4,43	4,70
—	10 2 Firing together.	4,07	4,10	4,15	4,22	4,27	4,39
—	12 2 Firing together.	4,04	4,05	4,08	4,11	4,12	4,16

TABLE III. FOR INTERMEDIATE SHAFTS OF SINGLE ACTING ENGINES.

MAXIMUM PRESSURE 25 AND UNDER 35 KG. PER CM^2.

4 Cycle Single Acting Engines. — Number of Cylinders.	2 Cycle Single Acting Engines. — Number of Cylinders.	Values of Coefficient C where					
		A = ·0015	A = ·0025	A = ·005	A = ·010	A = ·015	No Fly Wheel or Balance Weights.
1 or 2	1	4,33	4,59	5,23	6,31	—	—
3 or 4	2	4,19	4,24	4,34	4,59	4,83	6,67
5 or 6	3	4,16	4,18	4,22	4,32	4,42	5,08
7 or 8	4	4,10	4,14	4,18	4,30	4,40	4,90
9 or 10	5	4,07	4,08	4,11	4,17	4,21	4,42
11 or 12	6	4,06	4,06	4,08	4,11	4,13	4,23
—	7	4,05	4,05	4,06	4,08	4,10	4,16
—	8	4,04	4,04	4,04	4,04	4,04	4,06
—	9	4,03	4,03	4,03	4,03	4,03	4,03
—	10	4,03	4,03	4,03	4,03	4,03	4,03
—	11	4,02	4,02	4,02	4,02	4,02	4,02
—	12	4,02	4,02	4,02	4,02	4,02	4,02
—	4 2 Firing together.	4,19	4,29	4,59	5,00	5,26	6,55
—	6 2 Firing together.	4,18	4,23	4,41	4,66	4,81	5,41
—	8 2 Firing together.	4,12	4,18	4,28	4,43	4,51	4,80
—	10 2 Firing together.	4,10	4,12	4,18	4,27	4,31	4,43
—	12 2 Firing together.	4,05	4,07	4,10	4,14	4,15	4,20

TABLE IV. FOR INTERMEDIATE SHAFTS OF SINGLE ACTING ENGINES.

MAXIMUM PRESSURE 35 TO 50 KG. PER CM^2.

2 Cycle Single Acting Engines.

NUMBER OF CYLINDERS.	VALUES OF A.	VALUES OF COEFFICIENT C FOR THE FOLLOWING PISTON SPEEDS IN METRES PER MINUTE.			
		214 and below.	260	305	366 and above.
1 or 2	0,0015	4,45	4,41	4,39	4,37
	0,0025	4,75	4,70	4,64	4,58
	0,005	5,40	5,26	5,11	4,96
3	0,0015	4,22	4,21	4,20	4,18
	0,0025	4,37	4,33	4,29	4,26
	0,005	4,70	4,55	4,49	4,40
	0,010	5,14	4,88	4,69	4,54
4	0,0015	4,14	4,13	4,12	4,11
	0,0025	4,22	4,19	4,17	4,15
	0,005	4,38	4,31	4,25	4,21
	0,010	4,61	4,47	4,33	4,26
	0,015	4,75	4,52	4,38	4,28
5	0,0015	4,07	4,07	4,07	4,05
	0,0025	4,11	4,09	4,09	4,07
	0,005	4,18	4,15	4,11	4,09
	0,010	4,28	4,21	4,14	4,10
	0,015	4,33	4,24	4,16	4,11
	No Fly Wheel or Balance Weights.	4,47	4,32	4,21	4,13
6	0,0015 to 0,010	4,06	4,06	4,06	4,06
	0,015	4,10	4,06	4,06	4,06
	No Fly Wheel or Balance Weights.	4,15	4,06	4,06	4,06
7	All Values including No Fly Wheel or Balance Weights.	4,05	4,05	4,05	4,05
8	,,	4,04	4,04	4,04	4,04
9	,,	4,03	4,03	4,03	4,03
10	,,	4,03	4,03	4,03	4,03
11	,,	4,02	4,02	4,02	4,02
12	,,	4,02	4,02	4,02	4,02
4 2 Firing together.	0,0015	4,87	4,78	4,70	4,63
	0,0025	5,35	5,18	5,02	4,87
	0,005	6,16	5,77	5,45	5,19
6 2 Firing together.	0,0015	4,43	4,37	4,30	4,26
	0,0025	4,66	4,54	4,46	4,36
	0,005	5,06	4,79	4,61	4,48
	0,010	5,41	5,02	4,74	4,55
8 2 Firing together	0,0015	4,24	4,20	4,17	4,15
	0,0025	4,32	4,27	4,22	4,18
	0,005	4,53	4,38	4,27	4,21
	0,010	4,70	4,48	4,32	4,24
	0,015	4,78	4,50	4,34	4,25
	No Fly Wheel or Balance Weights.	4,99	4,60	4,39	4,27
10 2 Firing together.	0,0015	4,12	4,09	4,08	4,07
	0,0025	4,16	4,13	4,10	4,08
	0,005	4,24	4,18	4,13	4,08
	0,010	4,32	4,21	4,15	4,10
	0,015	4,35	4,22	4,16	4,10
	No Fly Wheel or Balance Weights.	4,42	4,25	4,17	4,12
12 2 Firing together.	0,0015 to 0,005	4,06	4,05	4,04	4,03
	0,010, 0,015 and No Fly Wheel or Balance Weights.	4,11	4,06	4,05	4,04

4 Cycle Single Acting Engines.

NUMBER OF CYLINDERS.	VALUES OF A.	VALUES OF COEFFICIENT C FOR THE FOLLOWING PISTON SPEEDS IN METRES PER MINUTE.			
		214 and below.	260	305	366 and above.
1, 2, 3 or 4	0,0015	4,40	4,36	4,33	4,29
	0,0025	4,66	4,59	4,50	4,45
	0,005	5,16	4,95	4,78	4,64
	0,010	5,72	5,34	5,05	4,81
5	0,0015	4,27	4,26	4,23	4,21
	0,0025	4,42	4,38	4,33	4,27
	0,005	4,77	4,61	4,48	4,38
	0,010	5,10	4,83	4,61	4,48
6	0,0015	4,20	4,18	4,16	4,14
	0,0025	4,30	4,26	4,22	4,19
	0,005	4,52	4,40	4,30	4,24
	0,010	4,75	4,53	4,38	4,28
	0,015	4,88	4,60	4,43	4,30
	No Fly Wheel or Balance Weights.	5,27	4,78	4,52	4,35
7	0,0015	4,17	4,14	4,13	4,12
	0,0025	4,24	4,21	4,18	4,16
	0,005	4,36	4,30	4,23	4,19
	0,010	4,53	4,36	4,28	4,21
	0,015	4,63	4,40	4,30	4,22
	No Fly Wheel or Balance Weights.	4,87	4,52	4,34	4,24
8	0,0015	4,13	4,11	4,10	4,08
	0,0025	4,18	4,15	4,12	4,10
	0,005	4,27	4,21	4,16	4,13
	0,010	4,37	4,25	4,19	4,14
	0,015	4,43	4,27	4,20	4,15
	No Fly Wheel or Balance Weights.	4,58	4,34	4,23	4,17
9	0,0015	4,10	4,09	4,08	4,07
	0,0025	4,14	4,11	4,10	4,08
	0,005	4,20	4,16	4,12	4,10
	0,010	4,26	4,18	4,13	4,11
	0,015	4,29	4,19	4,14	4,11
	No Fly Wheel or Balance Weights.	4,37	4,23	4,17	4,12
10	0,0015 to 0,015	4,13	4,09	4,06	4,06
	No Fly Wheel or Balance Weights.	4,22	4,14	4,10	4,06
11	All Values including No Fly Wheel or Balance Weights.	4,07	4,07	4,07	4,07
12	,,	4,05	4,05	4,05	4,05

DOUBLE ACTING ENGINES.

Rules for Determining Sizes of Shafts.

Section 4. 1.—(*a*) The crank, intermediate and other shafts, if of ordinary mild steel having a tensile breaking strength of 44-50 kg. per mm², are to be of not less diameters than those given by the following formulæ.

(*b*) Where shafts are proposed to be made of special high tensile steel, their sizes should be submitted for consideration.

2. **Crankshafts.**—(*a*) Where the designed maximum and mean indicated pressures are 35 and 7 kg. per cm² respectively, the diameter of the crankshaft of the main engines is not to be less than that given by the following formula:—

$$\text{Diameter of crankshaft, in millimetres} \quad \ldots \quad = \sqrt[3]{D^2 \times (AS + BL)}$$

where **D** = diameter of cylinder, in millimetres,

S = length of stroke, in millimetres,

L = span of bearings adjacent to a crank, measured from inner edge to inner edge, in millimetres.

A and **B** are coefficients found from **Table V.**

Where the designed maximum and mean indicated pressures are other than 35 and 7 kg. per cm² respectively, or where special arrangements of cranks and firing orders are adopted, also where balance weights are fitted to the crank webs and only light flywheels are fitted, the sizes of the shafting will be specially considered.

TABLE V. FOR CRANK SHAFTS OF DOUBLE ACTING ENGINES.

35 KG. PER CM² MAXIMUM PRESSURE AND 7 KG. PER CM² MEAN INDICATED PRESSURE (TOP AND BOTTOM).

2 Cycle Double Acting Engines.				4 Cycle Double Acting Engines.				
Number of Cylinders.	Arrangement of Cranks.	Values of Coefficients.		Number of Cylinders.	Arrangement of Cranks.	Particulars of Firing.	Values of Coefficients.	
		A	B				A	B
1	—	0,063	0,044	1	—	—	0,063	0,044
2	—	0,104	0,038	2	—	—	0,104	0,038
3	—	0,076	0,042	3	—	—	0,094	0,039
4		0,116	0,037					
4		0,159	0,034	4	—	—	0,159	0,034
5		0,127	0,036	6		No Simultaneous Firing.	0,127	0,037
6		0,141	0,035					
6		0,152	0,034	8		Two Cylinder Ends Fire together.	0,200	0,032
7		0,149	0,034					
8		0,189	0,032	6		Two Cylinder Ends Fire together.	0,185	0,032
9		0,196	0,032					
6		0,167	0,033	8		Four Cylinder Ends Fire together.	0,355	0,028
8		0,324	0,028					

For heavy oil engines, with not more than three cylinders, driving auxiliary machinery the diameters of the crankshafts may be five per cent less than given by the foregoing formula.

3. **Crank Webs of Solid Forged Shafts.**—In solid forged shafts the breadth of the webs should not be less than 1,33 times and the thickness not less than 0,56 times the diameter of the shaft as found by the foregoing formula, or, if these proportions are departed from, the webs are to be of equivalent strength.

4. **Crank Webs of Built Shafts.**—(*a*) The dimensions of the crank webs of built shafts are not to be less than those given by the following formulæ :—

$$h = 0{,}625 \times d$$

$$t = \sqrt{\frac{0{,}12 \times d^3}{h}}$$

where h is the thickness of the web, measured parallel to the axis, in millimetres,

t is the thickness of metal around the eyeholes, measured radially, in millimetres,

d is the diameter required for the crankshaft, in millimetres.

(*b*) Crank webs are to be securely shrunk on the body pieces and crank pins, or to be forced on by hydraulic pressure. One or two keys or cylindrical dowels are to be fitted at the junction of the body pieces and webs.

The Committee will be prepared to give consideration to the circumstances of any special case.

5. **Intermediate Shafts.**—Where the designed maximum pressure does not exceed 35 kg. per cm², the diameter of the intermediate shaft is not to be less than that given by the formula :—

$$\text{Diameter of intermediate shaft, in millimetres...} = 25{,}4\ C \sqrt[3]{\frac{B.H.P.}{R}}$$

Where **B.H.P.** = Designed maximum brake horse power.

R = Revolutions of engines per minute.

C is a coefficient found from **Table VI.** by interpolation from the values found for **A** and the piston speeds.

In using **Table VI.** the appropriate value of **A** is found thus :—

$$A = \frac{D^2 \times S \times 5760}{W \times d^2 \times R^2}$$

where **D** = diameter of cylinder, in millimetres,

S = length of stroke, in millimetres,

d = diameter of fly wheel, in millimetres.

R = revolutions of engines per minute,

W = total weight of fly wheel, in kgs.

Where a fly wheel is not fitted, but where there are special balance weights at the crank webs, the value of **A** may be found from the formula :—

$$A = \frac{D^2 \times S \times 5760}{6{,}24 \times w \times r^2 \times R^2}$$

where **D** = diameter of cylinder, in millimetres,

S = length of stroke, in millimetres,

r = radius of gyration of balance weights, in millimetres,

R = revolutions of engines per minute,

w = total weight of balance weights, in kgs.

Where a fly wheel and special balance weights are fitted, the value of **A** may be found from the formula :—

$$A = \frac{D^2 \times S \times 5760}{(6{,}24 \times wr^2 + Wd^2) \times R^2}$$

TABLE VI. FOR INTERMEDIATE SHAFTS OF DOUBLE ACTING ENGINES.

35 KG. PER CM^2 MAXIMUM PRESSURE.

2 Cycle Double Acting Engines.

Number of Cylinders.	Values of A.	Values of Coefficient C for the following Piston Speeds in Metres per Minute.			
		214 and below.	260	305	366 and above.
1	0,0015	4,48	4,47	4,46	4,44
	0,0025	4,82	4,79	4,75	4,71
2 Cranks at 90°	0,0015	4,21	4,20	4,19	4,18
	0,0025	4,35	4,31	4,28	4,26
	0,005	4,68	4,58	4,50	4,43
	0,010	5,15	4,92	4,74	4,59
2 Cranks at 180°	0,0015	4,69	4,65	4,61	4,57
	0,0025	5,14	5,06	4,95	4,86
3	0,0015	4,11	4,11	4,10	4,09
	0,0025	4,17	4,16	4,14	4,13
	0,005	4,30	4,25	4,21	4,18
	0,010	4,50	4,37	4,28	4,22
	0,015	4,62	4,47	4,32	4,25
	No Fly Wheel or Balance Weights.	5,15	4,70	4,47	4,31
4	0,0015	4,20	4,18	4,16	4,15
	0,0025	4,30	4,26	4,22	4,19
	0,005	4,53	4,41	4,31	4,25
	0,010	4,78	4,56	4,40	4,30
	0,015	4,91	4,63	4,47	4,32
	No Fly Wheel or Balance Weights.	5,35	4,84	4,55	4,38
5	0,0015 to 0,0025	4,05	4,04	4,04	4,04
	0,005 to 0,015	4,10	4,07	4,06	4,05
	No Fly Wheel or Balance Weights.	4,16	4,10	4,07	4,06
6	0,0015 to 0,0025	4,06	4,05	4,04	4,04
	0,005 to 0,015	4,12	4,09	4,07	4,05
	No Fly Wheel or Balance Weights.	4,16	4,11	4,08	4,06
7	All Values, including No Fly Wheel or Balance Weights.	4,04	4,04	4,04	4,04
8	,,	4,03	4,03	4,03	4,03
9	,,	4,02	4,02	4,02	4,02
6 	0,0015	4,19	4,17	4,15	4,13
	0,0025	4,27	4,23	4,19	4,16
	0,005	4,45	4,31	4,24	4,19
	0,010	4,60	4,40	4,28	4,21
	0,015	4,68	4,46	4,30	4,22
	No Fly Wheel or Balance Weights.	4,91	4,54	4,35	4,25
8 	0,0015	4,32	4,26	4,21	4,18
	0,0025	4,47	4,34	4,26	4,21
	0,005	4,64	4,46	4,31	4,23
	0,010	4,80	4,52	4,35	4,25
	0,015	4,86	4,55	4,37	4,26
	No Fly Wheel or Balance Weights.	5,03	4,62	4,40	4,28

4 Cycle Double Acting Engines.

Number of Cylinders.	Values of A.	Values of Coefficient C for the following Piston Speeds in Metres per Minute.			
		214 and below.	260	305	366 and above.
1	0,0015	4,59	4,57	4,55	4,52
	0,0025	5,01	4,96	4,91	4,85
2 Cranks at 90°	0,0015	4,54	4,52	4,47	4,44
	0,0025	4,89	4,81	4,73	4,64
2 Cranks at 180°	0,0015	4,97	4,91	4,85	4,78
	0,0025	5,54	5,41	5,27	5,15
3	0,0015	4,53	4,48	4,45	4,39
	0,0025	4,86	4,75	4,65	4,56
	0,005	5,45	5,20	4,98	4,80
4	0,0015	4,69	4,61	4,53	4,47
	0,0025	5,11	4,89	4,74	4,62
	0,005	5,65	5,24	5,03	4,81
6 No Simultaneous Firing.	0,0015	4,09	4,08	4,07	4,06
	0,0025	4,13	4,10	4,09	4,07
	0,005	4,18	4,14	4,11	4,08
	0,010	4,23	4,17	4,12	4,09
	0,015	4,26	4,18	4,13	4,10
	No Fly Wheel or Balance Weights.	4,34	4,21	4,14	4,11
8 2 Cylinder Ends Fire together.	0,0015	4,15	4,13	4,10	4,08
	0,0025	4,20	4,16	4,13	4,10
	0,005	4,28	4,20	4,15	4,12
	0,010	4,35	4,23	4,17	4,13
	0,015	4,38	4,24	4,18	4,13
	No Fly Wheel or Balance Weights.	4,48	4,27	4,19	4,14
6  2 Cylinder Ends Fire together.	0,0015	4,92	4,78	4,65	4,53
	0,0025	5,31	5,06	4,84	4,67
8  4 Cylinder Ends Fire together.	0,0015	5,07	4,84	4,67	4,53
	0,0025	5,39	5,07	4,80	4,62

6. **Fly Wheel Shaft.**—The diameter of the fly wheel shaft is to be at least equal to that of the crank shaft.

7. **Thrust Shaft.**—The diameter at the collars of thrust shafts transmitting torque is not to be less than 1,05 times that required for the intermediate shaft. Thrust shafts may be tapered down outside the collars to the diameter required for the intermediate shaft.

8. **Tube Shafts** (Shafts passing through stern tubes but not carrying the screw propellers).—The diameter of the tube shaft is not to be less than 1,05 times that required for the intermediate shaft, and any part of the shaft within the tube which may be exposed to sea water is not to be less than 1,075 times that required for the intermediate shaft.

9. **Screw Shafts** (Shafts carrying the screw propellers). —(*a*) The diameter of the screw shaft is not to be less than that given by the following formula :—

$$\text{Diameter of screw shaft, in millimetres} = d + \frac{P}{C}$$

where d is the diameter required for the intermediate shafts, in millimetres,

P is the diameter of the propeller, in millimetres,

C = 144 when the shaft is fitted with a continuous liner, or

C = 100 when the shaft is not fitted with a continuous liner.

(*b*) Screw shafts which run in stern tubes may have the end forward of the stern gland tapered down to a diameter, at the coupling flange, of 1,05 times d.

10. **Bronze Liners on Shafts.**—(*a*) The thickness of liners fitted on screw shafts or on tube shafts, in way of the bushes, is not to be less than that given by the following formulæ :—

$$t = \frac{d + 235}{32}$$

where t is the thickness of the liner, in millimetres,

d is the diameter required for the screw or tube shaft under the liner, in millimetres.

(*b*) The thickness of a continuous liner between the bushes is not to be less than 0,75t.

(*c*) Continuous liners should be cast in one piece, or, if made of two or more lengths, the junctions of the separate pieces are to be made by fusion through the whole thickness of the liner.

(*d*) Liners are to be carefully shrunk on, or forced on to the shafts by hydraulic pressure. Pins are not to be used to secure the liners.

(*e*) If the liner does not fit tightly between the bearings in the stern tube, the space between the shaft and the liner is to be charged or forced with a plastic material insoluble in water and non-corrosive.

(*f*) Effective means are to be provided for preventing water from having access to the shaft at the part between the after end of the liner and the propeller boss.

11. **Stern Bush.**—The length of the bearing in the stern bush next to and supporting the propeller, is not to be less than 4 times the diameter required for the screw shaft under the liner.

12. **Couplings.**—(*a*) The diameter of the coupling bolts at the joining faces of the couplings is not to be less than that given by the following formula :—

$$\left.\begin{array}{l}\text{Diameter of coupling}\\ \text{bolts, in millimetres}\end{array}\right\} = \sqrt{\frac{d^3}{3{,}5 \times n \times r}}$$

where d is the diameter required for the intermediate shafts, in millimetres,

n is the number of bolts in the coupling,

r is the radius of the pitch circle of the bolts, in millimetres.

(*b*) The thickness of the coupling flanges at the pitch circle of the bolt holes is not to be less than the diameter of the coupling bolts, at the face of the coupling. The thickness of the screw shaft coupling flange is not to be less than 0,25 of the diameter required for the intermediate shaft.

(*c*) The radius of the curvature at the fillet where the flange starts from the shaft, should not be less than 0,125 times the diameter of the shaft adjacent to the flange.

(*d*) Where couplings are separate from the shafts, provision is to be made to resist the astern pull.

13. **Bronze Propellers.**—Where bronze is used for propellers or propeller blades, it is to comply with the requirements of **Section 11** of the **Rules for Quality and Testing of Materials.**

GENERAL REQUIREMENTS FOR SINGLE AND DOUBLE ACTING ENGINES.

Section 5. 1. Where the cylinder liners are made of hard close grained cast iron of plain cylindrical form, accurately turned on the outside as well as bored on the inside so that their soundness can be ascertained by inspection, and their thickness at the upper part is not less than $\frac{1}{15}$ of the diameter of the cylinder, they need not be hydraulically tested by internal pressure. If, however, they are made of complicated form, the question of testing is to be submitted.

2. The water jackets of the cylinders, and the water passages of the cylinder covers and pistons, are to be tested by hydraulic pressure to 2,1 kg. per cm^2., and are to be perfectly tight at that pressure.

3. The exhaust pipes and silencers are to be efficiently water-cooled or lagged to prevent damage by heat, and if the exhaust is led overboard near the water-line, means are to be provided to prevent water from being syphoned back to the engine.

4. The cylinders are to be fitted with safety valves loaded to not more than 40 per cent above the designed maximum pressure in the cylinders and discharging where no damage can occur.

5. The air compressors and their coolers are to be so made as to be easy of access for overhaul and adjustment.

6. Where the fuel is injected into the cylinders by air pressure, one main air compressor should be provided for each main engine.

In single screw vessels, an auxiliary air compressor is to be provided of sufficient capacity to enable the engines to be kept at work at not less than two-thirds of the normal sea power.

In twin screw vessels where two sets of compressors are fitted, the auxiliary compressor is to be of sufficient capacity to enable one main engine to be kept at work at not less than two-thirds of its normal sea power. If in such engines each main compressor is sufficiently large to supply both engines, a smaller auxiliary compressor will be sufficient.

7. A small auxiliary compressor, which does not require compressed air for starting up, is to be fitted for first charging the air receivers.

8. At least one high pressure air receiver is to be arranged with connections to enable it to be used for fuel injection, in case the working receiver of either main engine is out of use from any cause.

9. Where only one scavenging blower is fitted, alternative or duplicate means for driving the blower are to be provided ready for use.

10. The water circulating pump sea suction is to be provided with an efficient strainer which can be cleared inside the vessel.

11. In vessels intended for open sea service and fitted with engines over 350 BHP in which the lubricating oil is circulated under pressure, a spare oil pump is to be supplied with all connections ready for immediate use, and two independent means are to be arranged for circulating water through the air cooler, where this is fitted.

In all vessels an additional water circulating pump is to be fitted and connected ready for immediate use.

The sea suction of the stand-by circulating water pump is to be independent of the main injection. The ballast pump sea inlet may be used for this purpose.

AIR RECEIVERS AND PIPES.

Section 6. 1. Compressed air receivers for starting air are to be supplied of sufficient capacity to permit of twelve consecutive startings of each main engine without replenishment.

2. Cylindrical receivers for containing air under high pressure, used either for starting or for the injection of fuel in oil engines, may be made either of seamless steel or of welded, or riveted, steel plates.

3. **Quality of Material.**—If made of welded or riveted, steel plates, the ordinary rules regarding steel material for boilers apply, which provide that where welding is employed, either in the longitudinal seams or at the ends, the material is to have a tensile strength not exceeding 47 kg. per mm^2. (**Section 5, clause 2, paragraph** (*a*) **Rules for Quality and Testing of Materials.**)

If the welding be not lap-welding, full details are to be submitted before the work is commenced.

4. In the case of seamless receivers, the rules for material will be the same as for boiler shells, but the permissible extension may be 2 per cent less than that required with boiler plates.

5. **Tensile and Bend Tests** are to be made from the material of **each** receiver. Where they are welded or riveted, the tests may be made, and the thicknesses verified, before the plates are bent into cylindrical form. In the case of seamless receivers, the thicknesses are to be verified by the Surveyor before the ends are closed in, and at this time the Surveyor is to select and mark the test pieces required from either of the open ends of the tube. The test pieces are to be annealed before test, so as to properly represent the finished material.

6. The permissible working pressure for welded or seamless receivers is to be determined by the following formulæ :—

$$WP = \frac{C \times S \times (t - 3{,}2)}{D}$$

for thicknesses of 16 mm. and above.

$$WP = \frac{C \times S \times (t - 1{,}6)}{D}$$

for thickness below 16 mm.

where **WP** is the working pressure in kilogrammes per cm².,
S is the minimum tensile strength of the steel shell plates in kilogrammes per mm².,
t is the thickness of the shell plates in millimetres,
D is the internal diameter in millimetres,
C=55 for seamless receivers of thickness 16 mm. and above,
C=49 for seamless receivers of thickness below 16 mm.
C=39 for welded receivers of thickness 16 mm. and above,
C=34 for welded receivers of thickness below 16 mm.

7. For flat end plates welded to cylindrical shells

$$WP = \frac{5200 \times t^2}{D^2}$$

where **WP** is the working pressure in kilogrammes per cm².,
t is the thickness in millimetres,
D is the internal diameter, in millimetres.

8. (*a*) The permissible working pressure for receivers made of riveted steel plates is to be determined by the rules regulating the working pressure of boilers; where end plates are dished outwards to partial spherical form and not fitted with stays the following formula is to be used

$$WP = \frac{25{,}7 \times S \times t}{R}$$

where **WP** is the working pressure in kilogrammes per cm²
t is the thickness in millimetres,
R is the inner radius of curvature of the end in millimetres, which is not to exceed the diameter of the shell,
S is the minimum tensile strength of plates in kilogrammes per mm².

The inside radius of curvature at the flange connecting the end to the cylindrical shell is not to be less than four times the thickness of the end plate and in no case less than 64 mm.

(*b*) Where the end has a manhole in it, 3 mm. is to be added to the thickness of the plate.

If the plate at the manhole is stiffened by flanging, the total depth of the flange from the outer surface, in millimetres, is to be at least

$$= \sqrt{t \times w}$$

where t is the thickness of plate in millimetres,
w is the minor axis of the hole in millimetres.

9. Each welded or seamless receiver is to be carefully annealed after manufacture, and before the hydraulic test.

10. Each welded or seamless receiver is to be subjected to a hydraulic test of twice the working pressure, which it shall withstand without permanent set.

11. Each receiver made of riveted steel plates for pressures up to 21 kg. per cm². is to be tested by hydraulic pressure to 1,5 times the working pressure, plus 3,5 kg. per cm². Where higher working pressures are used, the test pressure need not be more than 14 kg. per cm². above the working pressure.

12. All receivers above 150 mm. internal diameter are to be so made that the internal surfaces may be examined, and, wherever practicable, the openings for this purpose are to be sufficiently large for access. Means are to be provided for cleaning the inner surfaces by steam, or otherwise.

13. Each receiver which can be isolated is to be provided with a safety valve, adjusted to the maximum working pressure. If, however, the air compressor is fitted with a safety valve so arranged and adjusted that no greater pressure than that permitted can be admitted to the receivers, they need not be fitted with safety valves.

14. Each receiver is to be fitted with a drain arrangement at its lowest part, permitting oil and condensed water to be blown out.

15. Oil or air pipes subjected to high pressure are to comply with the requirements for steam pipes, **Section 13, clauses 7 and 16 (Rules for Engines and Boilers of Steam Vessels)**.

Where solid drawn steel pipes are used and the material complies with the requirements of **Section 16** of the **Rules for Quality and Testing of Materials,** the working pressure may be determined from the following formula :—

$$WP = \frac{(t - 1)}{D} \times 800$$

where **WP** is the working pressure in kilogrammes per cm². to which the pipes will be subjected,
D is the internal diameter of the pipes in millimetres,
t is the thickness of the pipes in millimetres.

Pipes which are subjected to a working pressure up to 70 kg. per cm². are to be tested hydraulically to at least twice the working pressure to which they will be subjected, and those subjected to a higher working pressure than 70 kg. per cm². to an hydraulic test of at least 70 kg. per cm². above their working pressure.

PUMPING ARRANGEMENTS.

Section 7. 1. The pumping arrangements are to be the same as would be required for steam vessels of similar size and power.

Where a bilge suction from the main water circulating pump is not fitted, an independent power pump direct bilge suction is to be fitted additional to the direct bilge suction required by **Section 4, clause 5** (*d*) of the **Rules for Engines and Boilers.**

2. One bilge pump worked from the main engines will be sufficient, where the brake horse power does not exeeed 350, provided that the independent power pump required by **Section 4, clause 4** of the **Rules for Engines and Boilers** be fitted.

3. Where the cooling water discharge from various parts of the engines is led to the bilges, special arrangements are to be made to deal with this water, in addition to the ordinary bilge pumping arrangements.

MISCELLANEOUS.

Section 8. 1. All oil fuel pipes, tanks and their fittings are to comply with the requirements of **Section 20 (Rules for Steel Vessels).**

2. Special attention is to be given to the ventilation of the engine room.

3. If the auxiliaries are worked by electricity, the cables, motors, control gear and electrical spares in connection with them are to be in accordance with the **Rules for Electrical Equipment.**

4. All pipes conveying fuel oil are, as far as possible, to be made of steel or iron.

SPARE GEAR.

Section 9. In vessels engaged on open sea service, the articles mentioned in the following list (so far as they are applicable) will be required to be carried, viz. :—

*For a single screw ship a propeller, or two blades with studs and nuts for one blade. The propeller or blades may be of cast iron, except for ships having the notation "Strengthened for Navigation in Ice."

For Main Engines.

*1 cylinder cover of each design used, complete with all valves, valve casings, springs and other fittings and, in addition, one complete set of valves for one cylinder, with their casings, springs and other fittings.

Fuel needle valves for half the number of cylinders of each engine.

*1 piston complete, with all piston rings, studs and nuts.

1 set of piston rings for one piston.

*1 complete cylinder liner.

Telescopic cooling pipes for one piston.

1 set of wheels for the cam shaft drive of one engine or six separate links with pins and rollers where chain drive is used for cam shaft or scavenge blower.

1 set of studs and nuts for one cylinder cover of each design used.

1 set of rubber rings for liner joints.

2 crosshead bearing bolts and nuts, or one gudgeon pin where trunk pistons are used.

1 complete crank pin bearing.

1 set of top end bearings.

1 set of packings for one piston rod for Double Acting Engines.

*1 piston rod for Double Acting Engines.

2 crank pin bearing bolts and nuts of each size used.

2 main bearing bolts and nuts.

1 set of pads of each hand for one face of Michell Thrust block.

1 set of coupling bolts of each size used.

For Main Engine Air Compressors and Pumps.

1 set of piston rings for one piston of each size used in the air compressor.

1 half set of suction and delivery valves for each size used in the air compressor.

Not less than 10 per cent of suction and delivery valves for the scavenge air pump where lift valves are used.

1 impeller, impeller shaft and bearings where scavenge blowers are used. Where more than one scavenge blower is fitted, and one of these is additional to the required capacity of blower or blowers, under full working conditions, no spare parts need be supplied provided the additional blower is arranged to be easily substituted for the working blowers.

1 set of bilge pump valves and seats.

1 additional fuel pump or all working parts for one fuel pump.

* Not required for vessels engaged on short voyages.

For each size of Auxiliary Heavy Oil Engine.

1 complete set of valves for one cylinder, with their springs and other fittings.

Fuel needle valves for half the number of cylinders.

1 set of piston rings for one piston.

1 set of studs and nuts for one cylinder cover.

2 crosshead bearing bolts and nuts, or one gudgeon pin where trunk pistons are used.

2 crank pin bearing bolts and nuts of each size used.

1 complete crank pin bearing.

1 complete top end bearing.

2 main bearing bolts and nuts.

1 set of piston rings for one piston of each size used in the air compressor.

1 half set of suction and delivery valves for each size used in the air compressor.

1 additional fuel pump or all working parts for one fuel pump.

For Auxiliary Air Compressors.

1 set of piston rings for one piston of each size used.

1 half set of suction and delivery valves of each size used.

71, Fenchurch Street, London, E.C.3.
29th October, 1936.

For Auxiliary Pumps.

1 set of valves of each size used for the liquid end of each pump.

For Donkey Boilers used for essential services at sea.

1 set of valves for the water end of the feed pump.

1 valve lid for feed check.

6 tube stoppers.

1 set of oil fuel burner nozzles complete with atomisers, etc., for one boiler.

General.

A quantity of assorted studs, bolts and nuts.

Steel bars and plates of various sizes.

A length of pipe of each size used, for the fuel delivery and injection air pipes to the main and auxiliary power cylinders, and the air delivery from the main and auxiliary compressors to the receivers, with unions and flanges suitable for each.

PERIODICAL SURVEYS.

Section 10. The periodical surveys of the machinery are detailed on pages 19 to 21 under "**Petrol, Paraffin, and Heavy Oil Engines.**"

By order of the Committee,
MALCOLM K. SCOTT,
Secretary.

RULES FOR ELECTRIC PROPELLING MACHINERY.

(For Tables, see pages 147–156).

GENERAL.

Section 1. In vessels propelled by electrical machinery, either wholly or partly by this means, the Rules with regard to machinery are the same as those relating to steam engines so far as regards the testing of material used in their construction and fitting of sea connections, suction and discharge pipes, shafting, stern tubes and propellers.

The following rules are also to be observed. These relate to the electric propulsion equipment, with such references to the mechanical equipment as are required for the successful operation of the combined system. Such requirements are additional to those detailed in the appropriate sections of the Rules.

CONSTRUCTION.

Section 2. 1. In vessels built under special survey and fitted with electric propelling machinery, the whole of the electrical machinery, including switch gear, control gear, cables, main and auxiliary generators, motors and exciters, are to be constructed under special survey.

Any alterations and additions to the installation which are made are to be carried out under the inspection, and to the satisfaction, of the Surveyors.

2. In the cases of electric propelling machinery or engines being built under special survey, the distinguishing mark ✠ will be noted in red, thus :—✠LMC or ✠NE.

3. In order to facilitate the inspection, the plans of the machinery, control gear, cables and electric circuits are to be submitted for approval.

4. The Surveyors are to examine the materials and workmanship from the commencement of the work until the final test of the machinery under full power working conditions has been satisfactorily carried out. Any defects are to be pointed out as early as possible.

5. Any novelty in the construction, operation or application of the machinery is to be reported to the Committee and submitted for approval.

STEAM ENGINES FOR PROPULSION GENERATORS.

Section 3. 1. **Governing.**—An efficient governor is to be incorporated, which is to be arranged so that when operating at rated speed and the rated load is thrown off, the maximum variation in speed is not to be sufficient to bring the emergency governor into operation, and the permanent variation is not to exceed four per cent of the rated speed.

NOTE :—Exhaust steam turbines working in conjunction with reciprocating engines require an emergency overspeed governor only.

2. **Speed Control.**—When the propeller speed is arranged to be varied by controlling the engine speed the control is to be arranged to permit increments and decrements of speed not exceeding one per cent of maximum speed between 50 per cent and 100 per cent of maximum rated speed.

3. **Maximum Speed.**—The engines are to be capable of withstanding for five minutes without injury a speed of 15 per cent in excess of the maximum rated speed.

4. **Emergency Governor.**—An emergency overspeed governor, independent of the main governor, is to be arranged to trip the throttle valve when the speed exceeds the rated maximum running speed by not less than 10 nor more than 15 per cent. It is also to be arranged for hand tripping.

5. **Mixed Pressure Turbines.**—If, in the case of a turbine, exhaust steam can be admitted to the lower stages, an automatic shut-off controlled by the governor and emergency trip is also to be provided.

6. **Bled Steam.**—When provision is made for bleeding steam from the intermediate stages of a turbine, non-return valves, or positive shut off valves operated through oil pressure by the emergency governor, are to be fitted.

7. **Torque Limiting.**—In cases where the arrangements permit a propelling motor to be connected to generating plant having a continuous capacity higher than the motor rating, means are to be provided to limit the continuous input to the motor to approximately five per cent above the torque for which the shaft is approved.

8. **Lubricating Oil.**—Steam turbine driven sets are to be provided with a suitable emergency supply of lubricating oil as required by **Section 9** of the **Rules for Steam Engines** and are to have in addition a gravity tank having sufficient reserve to maintain lubrication until the unloaded turbine comes to rest from its maximum rated running speed.

9. **Mechanical Balance.**—The engines and generators are to be so constructed, erected and supported that when running at any and every working speed all revolving and reciprocating parts are well balanced so as not to give rise to any appreciable vibration.

OIL ENGINES FOR PROPULSION GENERATORS.

Section 4. 1. **Governing.**—An efficient governor capable of rapidly shutting off the flow of oil fuel is to be provided. It is to keep the engine speed within seven per cent momentarily and three and a-half per cent permanently at full speed when full load is removed.

2. **Emergency Governor.** — A suitable overspeed emergency governor, independent of the main governor, is to be arranged to cut off the fuel from the cylinders when the speed exceeds the rated maximum running speed by approximately 20 per cent.

3. **Critical Speed.**—When coupled to the generator or generators the combined set must not run within the vicinity of a critical at any designed running speed.

4. **Rating.**—The engine is to be capable, for periods of one hour, of developing a load 10 per cent above its rated output within the limits of variation in speed defined in **clause 1** without undue heating of the engine or other mechanical trouble. The rated output in B.H.P. (unless otherwise approved) is to be the load required to drive the generators and all direct coupled auxiliaries at their continuous maximum rating for a period of 12 hours when working with a barometric pressure of 762 mm. of mercury and a surrounding air temperature of 62° F. (16·7° C.).

GENERAL REQUIREMENTS OF ELECTRIC PROPULSION MACHINES.

Section 5. 1. **Insulation.**—(*a*) All windings are to be insulated and treated to resist moisture, sea air and oil vapour.

(*b*) All windings are to be insulated from the frame with mica or micanite. Where it is desired to use other types of insulation, particulars regarding the behaviour, properties and life of the materials are to be submitted for consideration.

2. **Terminals.**—The terminals are to be so secured and spaced or shielded that they cannot be accidentally earthed, short circuited or touched. Cable conductors are to be furnished with appropriate sweating sockets.

3. **Coolers.**—If water coolers are employed they are to be arranged so as to prevent leakage or condensation from cooler tubes from entering the machines.

4. **Thermometers.**—Machines having an enclosed ventilating system or ducts for the exhaust air are to be fitted with thermometers for recording the temperature of the ventilating air as it leaves the machine.

5. **Ventilation.**—Ample provision is to be made for supplying cool air to and removing hot air from the machine and to avoid as far as practicable any intake of moist or oil-laden atmosphere.

Where the machines are not ventilated by a closed system, using water coolers, they are to be ventilated with cooling air not exceeding 120° F. (49° C.). In cases where the ventilating air exceeds 120° F. (49° C.) the permissible temperature rise of the machine is to be reduced by an amount equal to the excess temperature.

6. **Heating when Idle.**—All generators of 500 kw. or motors of 500 S.H.P. and over, are to be provided with efficient means for heating the windings, either electrically or otherwise, to prevent condensation when idle. If steam pipes are used for this purpose, the joints are not to be within the machine.

7. **Shaft Currents.**—Means are to be provided to prevent circulating currents passing from the journals to the bearings.

8. **Excitation.**—(*a*) Systems dependent on the auxiliary generators for excitation are to be capable of manœuvring and of maintaining power at all times with a fall of 10 per cent of excitation voltage at the bus-bars.

(*b*) For large equipments it is recommended that an alternative means of excitation should be provided. The auxiliary generators may constitute this reserve.

9. **Facilities for Inspection and Repair.**—For the purposes of inspection and repair, provision is to be made for the withdrawal and replacement of the field coils of direct current machines and salient pole alternating current machines, and for sufficient access to stator and armature coils. Facilities are to be provided for supporting the motor shaft to permit the withdrawal and inspection of bearing bushes. Wear-down gauges are to be supplied for generators of 1000 kw., and motors of 1000 S.H.P., and over.

10. **Mechanical Protection.**—Suitable handrails or screens are to be provided to prevent personal injury or the entrance of extraneous bodies. All live parts in excess of 250 volts to earth, are to be suitably guarded or enclosed. Machines are to be amply protected against drip and mechanical damage.

11. **Lubrication.**—(*a*) Means of lubrication are to be efficient at all running speeds and all normal working oil temperatures, and with the ship inclined from the normal at any angle up to 15° transversely and 10° longitudinally, and with rolling up to 22½° without the spilling of oil.

(*b*) Oil flingers or other suitable means are to be provided to prevent the lubricant from creeping along the shaft or otherwise gaining access to the insulation of the machine or any live part thereof.

12. **Position in Ship.**—(*a*) The machines are to be placed in well-ventilated compartments in which inflammable gases cannot accumulate, and in such a position as to be clear of all inflammable material. Unprotected woodwork or other combustible material is not to be fitted within a distance of 0,30 m. measured horizontally from, or within 1,20 m. measured vertically above the machines.

(*b*) The machines are to be placed in positions in which they are not exposed to risk of mechanical injury or to damage from water, steam or oil, and in all vessels engaged on open sea service they are preferably to be placed with their axes of rotation in a fore and aft direction. If placed athwartships end play is to be reduced to a minimum and provision made for the end thrust due to rolling of the vessel.

(*c*) Ventilation ducts are to be so arranged that water or extraneous bodies cannot drop into the machines.

13. **Foundations and Bilges.**—(*a*) Plans of the seatings for the main propulsion generators and motors, are to be submitted for approval.

(*b*) Special means are to be provided to prevent the accumulation of bilge water under the machines and a direct bilge suction should be fitted in the main motor room. It is recommended that permanent means of illumination of the bilges under the machines be provided.

14. **Manœuvring.**—The torque available for manœuvring is to be reasonably in excess of the trailing action of the propeller to enable the latter to be stopped or reversed in a reasonable time when the vessel is travelling at maximum service speed.

ALTERNATING CURRENT SYSTEMS.

Section 6. 1. **Limiting Pressures.**—The pressure, under normal working conditions, at any part of the system for equipments not exceeding 15000 S.H.P. per shaft is not to exceed the following values.

Between lines	...	3500 volts.
To earth ...	...	2020 volts.

Proposals involving higher voltages for larger equipments are to be submitted for consideration.

2. **Stator Laminations.**—(*a*) Laminations are to be securely clamped, and are to be efficiently and permanently supported around the whole of the periphery.

(*b*) Laminations are to be suitably insulated from one another with an approved durable material.

3. **Propulsion Generators.**—(*a*) The ratings and limits of permissible temperatures rise for alternators are to conform to Appendix 3. If the ventilating air exceeds 120° F. (49° C.) the permissible temperature rise is to be reduced by an amount equal to the excess temperature.

(*b*) Machines of 5000 k.v.a. and over, or machines having an axial core length of one metre or over, are to have at least three embedded temperature detectors and a temperature indicating instrument. Detectors of this type should be fitted to smaller machines where practicable.

(*c*) Suitable space is to be provided for the removal of the rotor for the inspection of the rotor and stator.

(*d*) Stator and rotor windings are to be suitable for manœuvring in accordance with **clause 6** (*b*) of this Section without impairment.

4. **Propulsion Motors.**—(*a*) The ratings and limits of permissible temperature rise for motors are to conform to Appendix 3.

(*b*) The collector rings and rotor terminals of synchronous type motors are to be suitably insulated for the voltage induced during manœuvring. Insulating barriers are to be provided where necessary.

(*c*) Induction rotor windings of synchronous type motors, used for manœuvring purposes, are to be mechanically strong and of ample section to prevent over-heating during repeated manœuvres in accordance with **clause 6** (*b*) of this Section.

(*d*) Provision is to be made for machining the collector rings or for their easy removal for that purpose.

(*e*) Machines of 5000 S.H.P. and over, or machines having an axial core length of one metre or over, are to have at least three embedded temperature detectors and a temperature indicating instrument. Detectors of this type should be fitted to smaller machines where practicable.

5. **Stability.**—The motors and generators are to be designed and arranged to maintain electrical stability and to remain in step under all normal conditions of running.

6. **Excitation.**—(*a*) Exciters, balancers, boosters and motors for driving them are to conform to Appendix 4, except that in tropical climates or where fixed in hot situations where the ventilating air adjacent to the machine

exceeds 120° F. (49° C.), the temperature rise at rated full load is not to exceed 63° F. (35° C.) all temperatures being measured by the thermometer.

(*b*) After a full load run of the complete equipment, for not less than three hours, followed by a full speed reversal and five normal manœuvres within a period of 30 minutes, the temperature rise of any machine supplying the extra excitation required for alternating current systems, is not to exceed that permitted in the preceding clause by 18° F.(10°C.).

(*c*) Field windings and all machines supplying over-excitation during manœuvring are to be capable of withstanding the excess current over a reasonable period, to allow for inadvertent delay during a reversal operation, without impairment, after attaining the temperature rise corresponding to normal continuous working.

(*d*) Negative boosters are, when necessary, to be provided with overspeed protection.

(*e*) The strength of shafts and couplings of exciting machines for alternating current equipments is to be suitable for the increased output necessary during manœuvring.

DIRECT CURRENT SYSTEMS.

Section 7. 1. **Limiting Pressures.**—For equipments not exceeding 15000 S.H.P. per shaft the pressure to earth at any part of the system under normal working conditions is not to exceed 600 volts. The voltage of any single armature is not to exceed 1000.

Proposals involving higher voltages for larger equipments are to be submitted for consideration.

2. **Propulsion Generators and Motors.**—The ratings and limits of permissible temperature rise are to conform to Appendix 3.

3. **Brush Gear.**—The brushes are to be staggered longitudinally to prevent the formation of ridges on the commutators and arranged in such manner that in multipolar machines every part of the commutator working surface is swept by an equal number of positive and negative brushes.

4. **Excitation.**—The arrangements for motor and generator excitation are to be such that if the motor excitation circuit is opened by a switch or contactor the generator excitation is simultaneously opened or the generator voltage is immediately reduced to zero.

5. **Overspeed Protection.** — Overspeed protection devices are to be arranged to interrupt the supply of power, and the armatures are to be suitably constructed to prevent damage due to temporary overspeeding, where the system permits excessive overspeeding at light loads.

GENERAL REQUIREMENTS FOR PROPULSION CONTROL GEAR AND SWITCHBOARDS.

Section 8. 1. **Position.**—(*a*) Control boards and switchboards are to be placed in accessible, well ventilated positions, free from inflammable gases and acid fumes, and in which they are not exposed to risk of mechanical injury or damage from water, steam or oil.

(*b*) Unprotected woodwork or other combustible material is not to be fitted within a distance of 0,30 m. of any live metal, measured horizontally from, or 1,20 m. measured vertically above, the panel.

(*c*) Essential controls for manœuvring operations are to be grouped at the starting platform and any necessary instruments and gauges are to be in direct view from this position.

2. **General Construction.**—(*a*) Switchboards and control panels are to be constructed wholly of durable, non-ignitable, non-absorbent materials.

(*b*) If insulating material be used for the base, it is to be of permanently high dielectric strength and insulation resistance, and full particulars regarding its properties should be submitted for consideration.

(*c*) If semi-insulating materials such as marble or slate are used, all conducting parts are to be insulated from the slate or marble slab with mica or other approved non-hygroscopic insulating material, and the slab is to be similarly insulated as a whole from the frame on which it is mounted; the frame is to be effectually earthed.

(*d*) The various live parts are to be so arranged, by suitable spacing or shielding with non-ignitable insulating materials, that an arc cannot be maintained between any such parts.

(*e*) All parts, including connections, are to be readily accessible from the front or back. Fuses are to be placed in approved positions.

(*f*) Omnibus bars and ordinary bare connecting conductors on switchboards are to be proportioned so that their average temperature will not rise more than 54° F. (30° C.) above that of the surrounding air when rated at 2000 amperes or below when the maximum current flows through them continuously. For bare conductors rated above 2000 amperes the temperature rise is not to exceed 72° F. (40° C.). The temperature rise of each part is not to exceed the average temperature by more than 9° F. (5° C.) and in other respects they are to comply with Appendix 1.

(*g*) All cable connections in the control and switchgear in any circuit essential for manœuvring or maintenance of propelling power are to be stranded and to consist of not less than seven strands and have a sectional area of not less than 2,90 mm². (7/0,75 mm.).

(*h*) All nuts and screws securing electrical connections are to be effectively locked so that they cannot become loose.

(*i*) All circuits, instruments and important apparatus are to be clearly and indelibly labelled for indentification. If detachable name plates are employed, they are to be non-ignitable, and if of metal are to be disposed so as not to involve risk of short circuits or earths.

(*j*) Each voltmeter, pilot or earth lamp with its connecting wires is to be protected individually by a fuse on each insulated pole close to the incoming supply. Pilot lamps and indicating lamps may have common fuses.

(*k*) Switches and contactors are as far as practicable to be connected so that their blades or moving parts are not alive in the "off" or de-energised position.

(*l*) Where switches and fuses are fitted on the same pole they are to be arranged so that the fuses are not alive when the corresponding switches are in the "off" position.

(*m*) Switches and circuit breakers are to conform to the **Rules for Electrical Equipment, Section 3, clause 5.**

(*n*) Fusible cut-outs are to comply with the **Rules for Electrical Equipment, Section 3, clause 6,** and are to be suitably labelled with the circuits or devices which they control.

(*o*) All levers, handles, handwheels, interlocks, and their connecting links, shafts and bearings for the operation of switches and contactors are to be of such proportions that they cannot be broken by manual operation.

(*p*) Suitable interlocks, preferably mechanical, are to be provided to prevent damage by improper operation, such as the opening of switches or contactors not intended to be operated while carrying current.

(*q*) Provision is to be made for the manual operation of all manœuving contactors, switches, field regulators or controllers with reasonable effort, without the aid of solenoids or other electric, pneumatic or hydraulic aid. If such aid be used for normal operation, failure of the electric, pneumatic or hydraulic aid must not result in interruption of power to the screw shaft and the device must be capable of purely manual operation without any delay in changing over to manual control.

NOTE:—This requirement does not apply to bridge control.

(*r*) The cases of all instruments using a higher pressure than 250 volts to earth, and secondary windings of instrument transformers, are to be earthed.

(*s*) Switches normally subject to arcing, such as the short circuiting and isolating switches for direct current generators connected in series, are to be provided with substantial and renewable arcing tips.

(*t*) All apparatus is to be arranged to function satisfactorily under conditions of vibration and shock, and with the ship inclined from the normal at any angle up to 15° transversely and 10° longitudinally, and when rolling up to $22\frac{1}{2}$° from the vertical.

(*u*) All devices dependent on current supplied from the auxiliary bus-bars are to be arranged to operate satisfactorily with a voltage variation from minus 10 per cent to plus 5 per cent.

(*v*) For the purpose of maintaining alignment and ease of operation, operating shafts are to be fitted with flexible couplings and expansion joints where necessary and means are to be provided for effective lubrication.

(*w*) All steel parts are to be suitably treated to resist corrosion.

3. **Overload and Short Circuit Protection.**—Provision is to be made for protection against severe overloads or electrical faults likely to result in serious injury to the plant, but the operating point is to be set sufficiently above the currents and loads usually experienced in a heavy sea-way or when manœuvring, to prevent interruption of power.

4. **Earth Detection.**—(*a*) The main propelling circuit is to be provided with means for detecting earth faults.

(*b*) For D.C. equipments exceeding 500 volts and for all A.C. equipments, aural and visual alarms are to be operated, but power supply is not to be interrupted on the occurence of a fault, so that the plant may continue to operate with a single earth. If an earth connection be used for the operation of the detector, the arrangements are to be such that the earth circuit is automatically opened in order to stop the circulation of fault current.

(*c*) Earth detection devices are to be arranged to function for all earth leakage faults exceeding 5 amperes. On three-phase alternating current systems at least 95 per cent of the generator and motor windings are to be protected.

(*d*) A switch may be installed to cut out the aural device to prevent continuous alarm, but in such case the visual device is to be automatically switched on when the aural device is switched off.

(*e*) Excitation circuits are to be provided with lamps, voltmeters or other suitable means to indicate continuously the state of the insulation of the system under running conditions.

5. **Mechanical Protection.**—All exposed current carrying parts having a potential of over 250 volts to earth are to conform to the following requirements :—

(*a*) Terminals are to be enclosed.

(*b*) The sides and rear of switchboards and control panels are to be suitably screened.

(*c*) Access doors are to have prominent and permanent nameplates giving the maximum voltage, and are to be interlocked to prevent access while such parts are alive, or in approved cases are to be provided with a special key under the care of the chief engineer.

(*d*) Exposed current carrying parts exceeding 250 volts to earth are not to be permitted on any switchboard or control panel.

6. **Bridge or Deck Control.**—(*a*) The control is to be simple and easy to operate.

(*b*) It is to be such that the operator cannot produce currents or loads in excess of the working capacity for which the plant is designed.

(*c*) Control is to be carried out without reference to electrical instruments.

(*d*) Alternative control in the engine room is to be provided, and so arranged that transfer of control to the engine room can be made in emergency without excessive loss of time.

(*e*) It is to be arranged so that simultaneous control of the propelling machinery from the bridge and engine room is not possible.

7. **Instruments and Gauges.**—(*a*) Instruments and gauges which are necessary for the efficient operation of the plant are to be provided. Particulars are to be submitted for consideration. In cases where the rotation of the propeller motors cannot readily be observed from the starting platform, indicators are to be provided.

(*b*) All essential instruments are to be capable of withstanding vibration and shock without impairment and are to be fitted in moisture-proof cases.

(*c*) Instruments are where necessary to be protected from the influence of stray magnetic fields.

(*d*) A 500-volt insulation tester, giving the resistance in megohms, for the purpose of testing and tracing faults is to be carried on all sea-going vessels.

8. **Discharge Protection.**—(*a*) For the protection of the field windings and cables efficient means are to be provided for limiting the induced voltage when the field circuits are opened.

(*b*) Where excitation is obtained from the auxiliary bus-bars efficient means are to be provided to limit the induced voltage on the bus-bars when the generator or distribution circuit breaker opens.

9. **Direct-current Systems.**—(*a*) Where two or more direct-current generators are connected in series, means are to be provided to prevent the reversal of the prime mover on the failure of the power supply to any one generator if such reversal would result in damage or overspeeding.

(*b*) If the regenerated energy transmitted by the propeller motor on stopping or reversing the propeller is of a magnitude that would cause an undue increase in the engine speed, means are to be provided for suitably absorbing or limiting such power.

(*c*) Where the propulsion generators are also to be used for other purposes, suitable overload protection and provision for voltage adjustment is to be made in conformity with the **Rules for Electrical Equipment.**

10. **Reversing Switches.**—(*a*) Contactors or switches used for reversing the rotation of the propeller, are to be mechanically interlocked to prevent the circuits for ahead and astern rotation being closed simultaneously.

(*b*) The reversing contactors or switches are also to be provided with means for forcing them open if they should become stuck in the closed position.

11. **Resistances.**—(*a*) Resistances are to comply with **Section 12, clause 2,** of the **Rules for Electrical Equipment.**

(*b*) Shunt resistances connected across the field circuit of synchronous propelling motors when they are functioning as induction motors are to be suitably insulated for the voltage induced when reversing and amply rated to allow for inadvertent delay during the reversing operation.

12. **Temperature Alarm.**—Machines having an enclosed ventilating system or ducts for the exhaust air, are to have an aural alarm device arranged to operate when the outgoing air exceeds the predetermined safe value.

13. **Reversing Levers and Handwheels.**—Propeller reversing levers or handwheels are to be clearly and permanently marked with the positions for "ahead" and "astern" working. Levers or handwheels placed athwartships are to be arranged for right hand or clockwise rotation for ahead working or if operated in a fore and aft direction to be arranged to correspond with the direction in which the vessel is moving.

14. **Auxiliary Power.**—Distribution circuits connected to the auxiliary bus-bars for excitation and lubricating oil pumps, etc., are to be suitably protected from interruption due to overloading of non-essential circuits.

15. **Speed Control.**—When the propeller speed is arranged to be varied by voltage control or similar electrical means, the control is to be arranged to permit an adjustment between 50 per cent and 100 per cent of maximum rated speed in steps not exceeding one per cent of the maximum speed.

CONDUCTORS AND CABLES.

Section 9. 1. **Conductors.**—(*a*) All conductors are to be of annealed copper conforming to the Standards of the International Electrotechnical Commission Publication No. 28.

(*b*) Where the insulating covering of the conductor contains sulphur, each wire to be efficiently and uniformly coated with tin free from all impurities.

(*c*) Conductors in any circuit essential for manœuvring or maintenance of propelling power are to be stranded and to consist of not less than seven strands and to have a sectional area not less than 2,90 mm². (7/0,75 mm.).

(*d*) The size of conductor is to be selected so that the drop in voltage, when carrying rated full load and overloads, is not greater than that allowed for in the design of the machines.

(*e*) The current in any conductor is not to exceed that given in **Table I.** when carrying current continuously or **Table III.** when intermittently loaded. In no case is a shorter rating than one half-hour to be taken. In the case of field discharge circuits, particulars should be submitted for consideration.

(*f*) Where multicore cables are used the sizes are to be submitted for approval.

(*g*) Bus-bars and connections are to be in accordance with Appendix 1 and, if used for connections to machines, must be rigidly and strongly supported, efficiently insulated and guarded, and protected from drip and jets of liquid or steam. Pipes are not to enter ducts containing such connections. Suitable means are to be arranged for draining any accumulation of moisture in ducts.

2. **Insulation and Protective Covering of Cables.**—(*a*) All cables are to conform to **Section 5** of the **Rules for Electrical Equipment.**

(*b*) For multicore cables the thickness of dielectric on each conductor is to be the same as for the same size of single core cable and the thickness of lead sheathing is to be in accordance with **Tables X., XI., XII.** and **XIII.** The bedding and diameter of wire armouring are to be in accordance with **Table VI.**

(*c*) All cables for pressures exceeding 250 volts to earth are to be lead covered and braided. They are also to be armoured or protected in an approved manner. The thickness of dielectric and lead covering is to conform to **Table V.** and **XII.** (1000 volt paper or varnished cambric insulated), **Table XI.** (660 volt rubber insulated) or **Table XIII.** (3,300 volt paper or varnished cambric insulated).

A dielectric test is to be applied to all cables in accordance with the **Rules for Electrical Equipment, Section 5, clause 7** (*a*), 3300 volt cable being tested at 10000 volts under the conditions laid down therein.

3. **Installing and Fixing of Cables.**—(*a*) All cables are to be installed and fixed in conformity with **Section 6** of the **Rules for Electrical Equipment.**

(*b*) Cables are to be run in accessible, well-ventilated positions where they can be easily inspected.

4. **Cables for Alternating Currents.**—(*a*) Single core lead covered cables are to have their lead sheaths bonded together and earthed only at approximately the mid-point of the cable run. The remainder of the run is to be carried on insulators to prevent the circulation of currents in the metal sheaths. The sheaths of multiconductor cables are to be earthed at each end and long runs should also be earthed intermediately.

(*b*) If armoured single core cables are used the armouring is to be of non-magnetic material.

(*c*) Magnetic material is not to be used between single core cables of a group. Where cables pass through bulkheads or steel panels, all the conductors of the same set are to pass through a non-ferrous plate or gland so that no magnetic material passes between the cables, and the clearance between the cables and magnetic material is to be not less than 75 mm.

NOTE :—This clause does not apply to cables carrying 10 amperes or less.

(*d*) Single core cables carrying 100 amperes or over are to be fixed not less than 75 mm. from parallel magnetic material.

(*e*) Single core cables are to be so arranged that the inductive effects of the group are practically eliminated.

5. **Cable Sockets.**—Large cable sockets are preferably to be secured by two or more studs or bolts, not exceeding 20 mm diameter, and the nuts securely locked.

6. **Synchronous Motor Cables.**—Cables connected to the collector rings of synchronous motors during manœuvring are to be suitable for the voltage induced during those periods.

7. **Interference with Magnetic Compasses.**—Single-conductor circuits carrying continuous current are to be arranged with lead and return conductors fitted as close to one another as possible. Tests are to be made during the adjustment of the compasses to determine the effect of switching the main circuits on and off and careful records are to be kept of any errors observed, whether corrected or not.

SECONDARY BATTERIES.

Section 10. 1. **General.**—All batteries are to conform to **Section 8** of the **Rules for Electrical Equipment.**

2. **Capacity.**—Batteries used for starting main propulsion engines in lieu of compressed air are to comply with the following :—

(*a*) If used for purposes other than starting, full particulars of the battery should be submitted for consideration.

These particulars should include the capacity which it is estimated will be required to give 12 starts in succession of one main engine, also details of the other uses for which the battery is intended; the facilities for charging should also be indicated.

(*b*) If used solely for starting main engines two batteries are to be fitted each capable of starting one main engine six times in succession without recharging. Details of the charging arrangements are to be submitted for consideration.

(*c*) Plans showing the location and arrangement of battery compartment are to be submitted for approval.

TRIALS.

Section 11. 1. **Works Tests.**—(*a*) The machines, switchgear, main cables and control gear, are to be tested in the presence of the Surveyors at the makers' works so far as practicable to ensure compliance with the requirements relating to temperature rise, dielectric strength, insulation resistance and operating characteristics.

(*b*) The dielectric test to be applied to the control gear is to be equal to the test for that part of the machine to which it is to be connected or otherwise is to be 1000 volts plus twice the rated voltage of the circuit with a minimum of 2000 volts between poles and between current carrying parts and earth; the test voltage is to be maintained for one minute.

(*c*) The rotor windings of turbine driven alternators are to be tested for insulation resistance when rotating at maximum rated speed, as well as at standstill.

2. **Ship Trials.**—After installation on board the entire propelling equipment is to be tested under working conditions and operated in the presence of the Surveyors and to their satisfaction.

The insultation resistance of the main windings of each machine in megohms should be not less than

$$\frac{3 \times \text{rated voltage}}{\text{rated k.v.a.} + 1000}$$

The insulation resistance of cables, field windings and control gear when isolated and separated for testing purposes should be not less than one megohm.

All insulation tests are to be made where possible when the machines are hot and with a D.C. voltage of about 500 applied for sufficient time for the indicator to become practically steady.

SPARE GEAR.

Section 12. Owing to the varied character of equipments an exact list of spares cannot be specified and a list should be submitted for consideration together with or subsequent to the submission of final plans. The following should be included as a minimum for all vessels engaged in open-sea service.

1. **For Generators, Motors and Exciters.**
   - One set of bearing bushes, with oil rings, if used, of each size and type for the propulsion generators, motor and exciter.
   - Two lines of brush holders of each size and type.
   - One set of carbon brushes for one generator, exciter, and one motor.
   - One shunt field coil of each size and kind used for D.C. generators, exciter and motors.
   - One set of insulation or insulated brush studs for two lines of brushes of each size and type.
   - In cases where there is no stand-by exciter or alternative means of excitation, spare armatures for the excitation machines may be required.
   - One set of slip rings for one motor if of the A.C. type.

2. **Switch and Control Gear.**
   - One set of contacts liable to burning or wear.
   - One set of springs.
   - Ten per cent of each different resistance element, but at least one of each.
   - One of each type of shunt wound coil used for contactors, relays, or trip coils.
   - Two fuse handles of each type and size, or 10 per cent, but not less than 12 of each type of cartridge or other non-rewireable cut-out.

3. **General.**
   - Special dismantling tools, if any, required for overhauling machines or control gear.
   - 100 metres of control cable.
   - A suitable quantity of insulating tape and fuse wire.

4. **Storing.**
   - Electrical spares should be protected against excessive heat, and against moisture and rodents, and should be periodically tested.

71, Fenchurch Street, London, E.C.3.
21*st June*, 1934.

By order of the Committee,
ANDREW SCOTT,
Secretary.

RULES FOR ELECTRICAL EQUIPMENT.

(For purposes other than Electric Propulsion.)

(For Tables, see pages 147-156).

GENERAL.

Section 1. 1. In cases in which electricity is used on board classed vessels for purposes other than propulsion of the ship, the following Rules are to be observed.

The machines, fittings and cables are to be inspected by the Surveyors.

In order to facilitate inspection, a diagram of the switchboard, also diagrams of the wiring of the installation showing the sizes of the cables, type of dielectric and maximum current in the circuits are to be submitted for approval. The diagrams are to state the insulating material used for the switchboard panels and the materials used for insulating bushes, if any.

Any alterations and additions to the installation which are made are to be carried out under the inspection, and to the satisfaction, of the Surveyors.

2. **Standard Systems.**—The following systems of distribution may be used :—

A. Parallel systems with constant pressure.
- (*a*) Single wire with hull return.
- (*b*) Two-wire with direct or single-phase alternating current.
- (*c*) Three-wire with direct current.
- (*d*) Three-phase three-wire.
- (*e*) Three-phase four-wire.

B. Series systems with constant current (direct current only).

3. **Limiting Pressures.**—The pressure of supply is not to exceed the following values :—

A. With direct-current constant-pressure systems :—
- (*a*) For power, 500 volts.
- (*b*) For lighting and heating, 250 volts.

B. With alternating-current constant-pressure systems :
- (*a*) For power and heating, 250 volts.
- (*b*) For lighting, 150 volts.

C. With constant-current series systems (direct current only) :—650 volts.

For ships carrying oil having a flash point less than 65·5° C.—*See* **Section 15.**

GENERATING PLANT.

Section 2. 1. **Rating of Generators.**—Generators are to conform to Appendix No. 2, except that in tropical climates, or where fixed in specially hot situations on the ship, the rated full load is not to be exceeded and the temperature rise at rated full load is not to exceed 35° C. on the windings and 40° C. on the commutator, all temperatures being measured by thermometer.

The tests are to be carried out at the makers' works and a certificate giving the results is to be submitted for approval. Machines of 100 kw. and over are to be inspected by the Surveyors during manufacture and testing.

2. **Automatic Regulation of Pressure.**—(*a*) Generators are to be compound wound unless arranged to run in parallel at such distances apart as to render the amount of copper in the equalizing conductors excessive, in which case they may be shunt wound. The series field windings of every compound generator are to be connected to the positive pole of the machine except on single wire systems with hull return, having the negative pole earthed, in which case they are to be connected to the negative pole.

(*b*) Generators, unless otherwise specified, are to be over-compounded 5 per cent under conditions of constant speed and excitation. Alternatively, they may be level compounded when tested coupled to their prime movers, under conditions of fixed excitation.

3. **Field Regulators.**—Where generators are run in parallel each is to be fitted with an adjustable regulating resistance in series with its shunt field, to vary the pressure of the generator between 5 per cent above, and 10 per cent below the normal at any load, and there are not to be less than 25 equal steps of resistance.

4. **Brush Gear.**—(*a*) The brushes are to be of carbon and are to be provided with flexible copper connections.

(*b*) Means are to be provided for the adjustment of the brushes longitudinally so that they may be staggered to prevent the formation of ridges, in such a manner that in multipolar machines every part of the commutator working surface will be swept by an equal number of positive and negative brushes.

5. **Terminals.**—(*a*) Suitable terminals, clearly marked are to be provided in an accessible position convenient for wiring, and they are to be furnished with appropriate cable sweating sockets.

(*b*) The terminals are to be so spaced or shielded that they cannot be accidentally earthed, short-circuited, or touched.

6. **Lubrication.**—(*a*) Generators are to be efficiently and continuously lubricated automatically with the base of the machine inclined at any angle up to 15 degrees from the horizontal in any and every direction.

(*b*) If ring lubrication be employed, the rings are to be so constrained that they cannot leave the shaft.

(*c*) Oil flingers or other suitable means are to be provided to prevent the lubricant from creeping along the shaft, or otherwise gaining access to the insulation of the machine or any live part thereof.

(*d*) Each oil lubricated bearing is to be provided with a suitable overflow which, while permitting efficient lubrication when the machine is running, shall prevent excess of oil.

7. **Ventilation.**—Generators are to be so placed that when working they obtain a sufficient supply of cool air, and provision is to be made for removal of the heated air after passing through the machine.

8. **Position in Ship.**—(*a*) The generators are to be placed in a well-ventilated compartment in which inflammable gases cannot accumulate, and in such a position as to be clear of all inflammable material. Unprotected woodwork or other combustible material is not to be fitted within a distance of 0,30 m. measured horizontally from, or within 1,20 m. measured vertically above, the generators.

(*b*) The generators are to be placed in positions in which they are not exposed to risk of mechanical injury or to damage from water, steam or oil, and in all sea-going ships they are to be placed with their axes of rotation in a fore and aft direction.

9. **Plant to be Earthed.**—The bedplate and frame of the generating plant are to be efficiently earthed, and insulation is not to be interposed between the prime mover and the generator.

10. **Protection of Connections between Generator and Main Switchboard.**—When a generator is placed in a compartment other than that containing the main switchboard, each such generator is to be provided with a fuse or circuit breaker on each insulated pole, fitted as near as possible to the terminals of the generator. This protection is to be additional to that provided on the main switchboard.

11. **Emergency Trip.**—Where a turbine-driven direct-current generator is arranged to run in parallel with other generators, a switch is to be fitted on each turbine emergency governor to open the generator circuit breaker when the emergency governor functions.

SWITCHBOARDS.

Section 3. 1. **Position.**—(*a*) Switchboards are to be placed in accessible positions, free from inflammable gases and acid fumes, in which they are not exposed to risk of mechanical injury or to damage from water, steam or oil.

(*b*) Unprotected woodwork or other combustible material is not to be fitted within a distance of 0,30 m. of any live metal measured horizontally from, or within 1,20 m. measured vertically above, the switchboard.

(*c*) Cupboards or compartments containing switchboards must be composed of fire-resisting material or approved lining.

2. **General Construction.**—(*a*) Switchboards are to be constructed wholly of durable, non-ignitable, non-absorbent materials.

(*b*) If insulating material be used for the base, it is to be of permanently high dielectric strength and insulating resistance, and should be submitted for consideration.

NOTE.—In the case of approved synthetic materials, it will be necessary for the manufacturers to demonstrate from time to time that the necessary qualities of the materials supplied by them are being maintained.

(*c*) If semi-insulating materials such as marble or slate are used, all conducting parts are to be insulated from the slate or marble slab with mica or other approved non-hygroscopic insulating material, and the slab is to be similarly insulated as a whole from the frame on which it is mounted; the frame is to be effectually earthed.

(*d*) The various live parts are to be so arranged, by suitable spacing or shielding with non-ignitable insulating materials, that an arc cannot be maintained between any such parts.

(*e*) All parts, including connections, are to be readily accessible from the front or back. Fuses may be placed on a framework behind the switchboard provided they be well clear of busbars, connections, circuit breakers and live parts; that they be easily accessible and a clear and unobstructed gangway of not less than 600 mm. be provided.

(*f*) All nuts and screws securing electrical connections are to be effectively locked, so that they cannot become loose.

(*g*) All omnibus bars and connections on switchboards are to be in accordance with Appendix No. 1.

(*h*) All circuits, instruments and important apparatus are to be clearly and indelibly labelled for identification. If detachable name plates be employed, they are to be non-ignitable, and if of metal are to be so disposed as not to involve risk of causing short circuits or earths.

(*i*) Omnibus bars and ordinary connecting conductors on switchboards are to be so proportioned that their average temperature will not rise more than 30° C. above that of the surrounding air when the maximum current flows through them continuously, and the temperature rise of each part is not to exceed the average temperature by more than 5° C.

(*j*) Every equalizer switch and its connections (including the cable from the generator) is to have a current carrying capacity of not less than 50 per cent of the main current of the generator.

(*k*) Each voltmeter, pilot or earth lamp, with its connecting wires, is to be protected individually by a fuse on each insulated pole.

(*l*) Switches are to be so connected to omnibus bars that their blades or moving parts are not alive in the "off" position.

(*m*) Where switches and fuses are fitted on the same pole, they are to be so arranged that the fuses are not alive when the corresponding switches are in the "off" position.

(*n*) Where single-pole switches or fuse-switches are required by these regulations, they are to be fitted on the same pole throughout the installation.

(*o*) Where a separate fuse and switch or separate fuses and linked switches are required by these regulations, they may be replaced by a fuse-switch or linked fuse-switches, as the case may be.

3. **Main Switchgear.**—Each main switch-board is to be fitted with the following switchgear as a minimum.

A. Two-wire Systems.

Where only one generator is installed:

(*a*) For the Generator:—

(i) Either a single-pole overload circuit breaker or a single-pole fuse and a single-pole-switch on the insulated pole in a single-conductor or a two-conductor earthed system.

(ii) Either a double-pole overload circuit breaker or a fuse on each pole and a double-pole linked switch in a two-conductor insulated system.

(*b*) For each Outgoing Circuit:—

(i) A single-pole fuse and a single-pole switch on the insulated pole in a single-conductor or a two-conductor earthed system.

(ii) A fuse on each pole and a single-pole switch on one pole in a two-conductor insulated system. All these switches are to be on the same pole.

Where more than one generator is installed, the generators not being arranged to run parallel:

(*c*) For each Generator:—

(i) Either a single-pole overload circuit breaker, or a single-pole fuse and a single-pole switch, on the insulated pole in a single-conductor or a two-conductor earthed system.

(ii) Either a double-pole overload circuit breaker, or a fuse on each pole and a double-pole linked switch in a two-conductor insulated system.

(*d*) For each Outgoing Circuit:—

(i) A single-pole fuse and a single-pole change-over switch on the insulated pole in a single-conductor or a two-conductor earthed system.

(ii) A fuse on each pole and a single-pole change-over switch on one pole, all such change-over switches being on the same pole, in a two-conductor insulated system.

Where more than one generator is installed, the generators being arranged to run in parallel:

(*e*) For each generator, if shunt wound:—

A circuit breaker with overload and reversed current trips. This circuit breaker to be:—

(i) Single-pole in a single-conductor or a two-conductor earthed system.

(ii) Double-pole in a two-conductor insulated system.

(*f*) For each generator, if compound wound:—

A circuit breaker with overload and reversed-current trips, and a single-pole equalizer switch so interlocked with the circuit breaker that this equalizer switch must be closed before the circuit breaker, and cannot be opened until the main circuit is broken. This circuit breaker to be:—

(i) Single-pole in a single-conductor or a two-conductor earthed system.

(ii) Double-pole in a two-conductor insulated system.

(*g*) For each Outgoing Circuit :—

(i) A single-pole fuse and switch on the insulated pole in a single-conductor or a two-conductor earthed system.

(ii) A fuse on each pole and a single-pole switch on one pole in a two-conductor insulated system. All these switches are to be on the same pole.

B. Three-wire Systems.

Where more than one generator is installed, the generators being arranged to run in parallel, whether the machines are wound for the full pressure or for half pressure and act as balancers :—

(*a*) For each generator, if shunt-wound :—

A double-pole circuit breaker with overload and reversed-current trips.

(*b*) For each generator, if compound-wound :—

A double-pole circuit breaker with overload and reversed current-trips, and a single-pole equalizer switch so interlocked with the circuit breaker that this equalizer switch must be closed before the circuit breaker, and cannot be opened until the main circuit is broken.

(*c*) For each outgoing three-wire circuit where the supply is given to three conductors :—

Either a double-pole overload circuit-breaker controlling the outer conductors, or a fuse on each outer conductor and a double-pole linked switch controlling the outer conductors. A fuse or switch is not to be included in the neutral conductor, but this requirement does not preclude the provision of an isolating link for testing purposes.

(*d*) For each outgoing two-conductor insulated circuit where the supply is given from the neutral and one outer of a three-wire system :—

Either a double-pole overload circuit breaker, or a double pole linked switch with a fuse on each pole.

(*e*) For each outgoing single-conductor or two-conductor earthed circuit where the supply is given from the neutral and an outer of a three-wire system :—

Either a double-pole circuit breaker with overload trip on that pole which is connected to the outer conductor, or a single pole fuse on that pole which is connected to the outer conductor and a double-pole linked switch.

C. Three-phase Three-wire Systems.

(*a*) For each generator :—

A triple-pole circuit-breaker with overload trips on at least two phases.

(*b*) For each outgoing three-conductor circuit to which a supply is given from the three conductors :—

Either a triple-pole circuit breaker with overload trips on at least two phases, or a triple pole linked switch with a fuse on each pole.

(*c*) For each outgoing two-wire circuit to which a supply is given from any two of the three conductors :—

Either a double-pole overload circuit breaker, or a double-pole linked switch with a fuse on each pole.

D. Three-phase Four-wire Systems.

(*a*) For each generator :—

A triple-pole circuit breaker with an overload trip on each phase.

(*b*) For each outgoing three-conductor circuit to which a supply is given from the three conductors :—

Either a triple pole circuit breaker with overload trips on at least two phases, or a triple-pole linked switch with a fuse on each pole.

(*c*) For each outgoing two-wire circuit to which a supply is given from one of the three conductors and the neutral :—

Either a single-pole overload circuit-breaker, or a single-pole switch and single-pole fuse, placed on that side of the circuit which is connected to one of the three phases.

(*d*) For each outgoing four-wire circuit used to supply a distribution switchboard from which three-wire or two-wire circuits radiate :—

Either a triple-pole circuit-breaker with an overload trip on each phase, or a triple-pole linked switch with a fuse on each pole. A fuse or switch is not to be included in the neutral conductor, but this requirement does not preclude the provision of an isolating link for testing purposes.

4. **Instruments.**—Each main switchboard is to be provided with the following instruments as a minimum :—

A. Two-wire Systems.

(*a*) Where only one generator is installed, one ammeter and one voltmeter, except in the case of tugs and similar vessels.

(*b*) Where more than one generator is installed, the generators not being arranged to run in parallel, an ammeter for each generator and one voltmeter, for use on any generator, fitted with a linked double-pole multiple-way switch or plug.

(*c*) Where more than one generator is installed, the generators being arranged to run in parallel, an ammeter for each generator, and two voltmeters; also a synchronizing device for paralleling purposes if the current be alternating. For compound machines the ammeter is to be connected on the opposite pole from that to which the equalizer connection is made. One of these voltmeters is to be fitted with a linked double-pole multiple-way switch or plug enabling it to be connected to any one generator before the machine is put in circuit; the other voltmeter is to be permanently connected to the omnibus bars.

B. Three-wire Systems.

In addition to the instruments required for two-wire systems a voltmeter is to be connected between the neutral and each outer omnibus bar; also a central zero ammeter in the main neutral conductor.

C. Three-phase Systems.

(*a*) Where only one generator is installed, an ammeter on each phase, and one voltmeter, except in the case of tugs and similar vessels.

(*b*) Where more than one generator is installed, the generators being arranged to run in parallel, an ammeter on each phase for each generator, two voltmeters and a synchronizing device for paralleling purposes. One of these voltmeters is to be fitted with a linked double-pole multiple-way switch or plug enabling it to be connected to one phase of any one generator before the machine is put in circuit. The other voltmeter is to be permanently connected to one phase of the omnibus bars. All these voltmeter connections are to be made to the same phase in each case.

D. Earth Testing.

Main switchboards, except in the case of tugs and similar vessels where only one generator is installed, are to be provided with suitable means for indicating the state of the insulation of the system, either by lamps, voltmeters, or otherwise.

5. **Switches and Circuit Breakers.**—Each switch, fuse-switch, and other circuit breaker is to comply with the following requirements:—

(*a*) All parts are to be so proportioned that when the normal current for which they are designed flows through them continuously, their temperature will not rise above that of the surrounding air more than 20° C. in the case of switches rated below 100 ampéres, and 30° C. in the case of switches rated at 100 ampéres or above.

(*b*) Each fuse-switch when opening the circuit as a switch, and each switch, shall break the circuit without permitting an arc to be maintained when a current 50 per cent greater than that for which it is rated is flowing under a pressure 50 per cent in excess of the pressure of supply. Each fuse-switch when opening the circuit as a fuse, and each circuit breaker, is to comply with the Rule for fusible cut-outs.

(*c*) Each circuit-opening device is to be so constructed and arranged that when placed in the off position it cannot accidentally move sufficiently to close the circuit.

(*d*) If the current to be interrupted be sufficiently large to cause damage to the main contacts, suitable arrangements are to be made for the easy renewal of the parts on which the arc is formed.

(*e*) The handles and their attachments are to be mechanically strong, and the exposed surface is to consist entirely of insulating material, or of metal. They are to be so designed and arranged that the hand of the operator cannot accidentally touch live metal or be injured through an arc arising from the switch or an adjacent fuse blowing. They are not to operate through open slotted holes.

(*f*) The bases are to be of durable, non-ignitable, insulating, non-absorbent material, and are to comply with the following conditions, viz.:—

(i) Semi-hygroscopic materials such as slate or marble, if used, are to be free from metallic veins, cracks or other defects.

(ii) The slabs are to be planed all over and, if of slate, treated, after drying, with a damp proof medium, all holes being similarly treated.

(iii) Bolts for securing marble or slate slabs to a metallic framework or case are to be insulated from the slabs, and the latter from the framework or case, by non-hygroscopic insulating bushes and washers.

(*g*) Where switches are not fixed on a switchboard, the live parts are to be enclosed by covers of non-ignitable material. In positions in which the switches are liable to mechanical injury the covers are to be of rigid metal or protected by a suitable guard. In other positions the covers may be either of rigid metal or non-conducting material. Metal cases are to be well clear of live parts, and where the switches are rated for currents exceeding 6 amperes at pressures exceeding 125 volts they are to be lined with non-ignitable insulating material.

(*h*) All switches fixed in positions exposed to the weather, to drip, or to an excessively moist atmosphere, are to be contained in watertight cases, which are to be provided with cable glands or bushings, or be adapted to receive screwed conduit, according to the way in which the cables entering the fittings are run.

(*i*) Each electro-magnetic circuit breaker is to be provided with suitable means of adjustment for determining the current at which it opens, and is to be so arranged that it cannot be held in against this current.

(*j*) Circuit breakers are to be so arranged and placed that no inflammable material is endangered by their coming into action.

6. **Fusible Cut-outs.**—Each cut-out is to comply with the following requirements :—

(*a*) All parts other than the fusible metal are to be so proportioned that their temperature will not rise more than 30° C. above that of the surrounding air when the normal working current for which they are designed flows through them continuously.

(*b*) The fuse is to be of such a size that it would be melted in one minute or less (two minutes or less in the case of a lead-tin alloy fuse) by a current equal to twice the rating of the smallest cable protected by it (as given in **Table IX.**) provided that no fuse smaller than one rated to blow at 7 amperes need be inserted in any final sub-circuit, and that for the purposes of this regulation, the current carrying capacity of a flexible cord or cable is considered to be equal to that of a rubber insulated cable of equal cross section.

Table IX. gives the approximate fusing currents for wires of copper and lead-tin alloy respectively.

(*c*) Each cut-out is to be of an approved type and is to be prominently and permanently labelled with the current carrying capacity of the cable protected by it.

(*d*) Each cut-out is to be provided with a suitable non-ignitable and insulating carrier for the fuse, of such form as to protect a person handling it from shock and burns.

(*e*) Contacts are to be provided on the carrier to which the ends of the fuse can be readily attached.

(*f*) The bases of cut-outs are to be of durable, non-ignitable, non-absorbent, insulating material and are to be provided with fixed circuit contacts of such form as to retain the carrier in position in the presence of vibration.

(*g*) The circuit contacts and their terminals are to be so spaced or shielded that an arc cannot be maintained when a fuse is blown.

(*h*) Fuses are not to be placed in switches, wall plugs, sockets, or in ceiling roses.

(*i*) Where cut-outs are not fixed on a switchboard they are to be grouped on section or distribution boards, or they are to be contained within cases conforming in all respects to the requirements of **clause 7** of this Section.

7. **Joint Boxes, Section and Distribution Boards.**—(*a*) Joint Boxes, Section and Distribution Boards are to be in accordance with **clauses 1** and **2** of this Section, as regards position and general construction. The fuses fitted in section and distribution boards are to conform with **clause 6** of this Section.

(*b*) Each section or distribution board is to be contained within a protecting case, unless of such size that they are contained in separate compartments or spaces in the ship.

(*c*) The cases are to be of metal, except in passenger and other accommodation and in crew spaces, where they may be of wood.

(*d*) All metal cases are to be lined with non-ignitable insulating shields opposite switches and cut-outs, whether such cut-outs are of the enclosed or open type, and all live parts therein are not to be less than 38 mm. clear of the case.

(*e*) All soft-wood cases are to be lined with non-ignitable insulating material, which is to clear all live parts by not less than 25 mm. Cases of hard wood, such as teak need not be so lined.

(*f*) Boxes not provided with backs forming an integral portion thereof are to be fitted with a non-ignitable insulating shield between their contents and the bulkhead, or any other structure to which they are fixed.

(*g*) Where glass fronts are provided they are to clear all live parts by not less than 25 mm. Where the boxes are of metal, glass fronts may be regarded as insulating shields.

(*h*) All cases fixed in positions exposed to the weather, to drip, or to an excessively moist atmosphere, are to be watertight, and are to be provided with cable glands or bushings, or be adapted to receive screwed conduit, according to the way in which the cables entering these fittings are run.

CONDUCTORS.

Section 4. 1. **Material.**—(*a*) All conductors are to be of annealed copper conforming to the Standards of the International Electro-Technical Commission, Publication No. 28.

(*b*) Where the insulating covering of the conductor contains sulphur, each wire is to be efficiently and uniformly coated with tin free from all impurities.

2. **Minimum Size of Conductor.**—A cable having a conductor of less sectional area than 1 mm². is not to be used except for wiring ornamental fittings which cannot admit this cable; the sectional area of the conductor of the cable for such fittings is not to be less than 0,39 mm².

3. **Maximum Size of Single Wire.**—All conductors having an effective sectional area exceeding 2 mm². are to be stranded.

4. **Proportioning of Conductors to Current Carried.**—The size of conductors is to be so selected that the fall of pressure between the main switchboard omnibus bars and any, and every, point of the installation when carrying the maximum load probable under the heaviest conditions of service will not exceed 2 volts plus 3 per cent of the omnibus bar pressure for lighting and 2 volts plus 5 per cent of the omnibus bar pressure for power and heating circuits, provided that in each case the current will not exceed that given in **Table I.** for each size of conductor when this maximum current is being carried and that **clause 2** of this Section be complied with.

5. **Conductors Intermittently Loaded.**—**Table III.** gives the maximum permissible currents for half-hour and one-hour ratings, and the sizes of cables which may be used for such ratings in place of the cables specified in **Table I.** for continuous loading. In no case is a shorter rating than one half-hour to be taken whatever may be the degree of intermittency.

6. **Standard Sizes.**—The sizes of conductor shown in **Tables I.** and **II.** are recognised as standard for ships' installations. These Tables show the maximum current that each size may carry when the length of conductor is such that the fall of pressure does not exceed that corresponding to the percentage limits laid down in **clause 4** of this Section. The Tables also show the total length of conductor in circuit that will give a drop of pressure of 1 volt when such maximum current is being carried. In **Table I.** allowance is made for the class of insulation with which the conductor is covered.

INSULATION AND PROTECTIVE COVERING OF CABLES.

Section 5. 1. **Types of Cables.**—Only the following types of cables are to be employed, either single, twin, concentric or multicore:—

(*a*) Vulcanized rubber insulated.

(i) Braided.

(ii) Tough rubber sheathed (with or without braiding over the sheathing). For thickness of tough rubber sheathing, *see* **Table X.**

(iii) Lead covered (with or without braiding over the lead).

(iv) Lead covered and armoured (with or without braiding over the armour).

(v) Braided and armoured (with or without braiding over the armour).

(*b*) Paper insulated.

(i) Lead covered (with or without braiding over the lead).

(ii) Lead covered and armoured (with or without braiding over the armour).

(*c*) Varnished cambric insulated.

(i) The dimensions and current carrying capacities to be as specified in **Tables I., III.** and **V.** respectively.

(ii) The cables are to withstand the pressure test and other tests specified for paper insulated cables for 1000 volts.

(iii) The cables are to be lead covered, or lead covered and armoured (with or without braiding over the lead or armour).

(iv) The installing and fixing of the cables to be in accordance with the regulations for paper insulated cables. (*See* **Section 6.**)

(v) When yellow varnished cambric is used as the di-electric a suitable separator or tinning of the conductor is to be employed to prevent chemical action on the copper.

Where it is desired to use types of cables insulated otherwise than here specified, a report from a recognised testing authority regarding the behaviour, properties and life of the insulating materials employed, is to be submitted for consideration.

2. **Vulcanized Rubber Insulated Cables.**—(*a*) Vulcanized rubber insulated cables are to be insulated with a layer of pure rubber next to the conductor, an intermediate layer of vulcanizing rubber, and an outer jacket of vulcanizing rubber. These three layers are to constitute the dielectric. Alternatively, vulcanized rubber insulated cables may be insulated with a homogeneous dielectric consisting of vulcanized rubber applied in one or more layers, provided the quality of the tinning is such that there is no corrosion of the tinning in the finished cable. The radial thickness

of dielectric is not to be less than that specified in **column 3** of **Table IV.** The dielectric is to be surrounded by a layer of waterproof tape, and the whole is to be vulcanized together.

(*b*) Braided cables are to have an exterior braiding of hemp, cotton or jute thoroughly impregnated with a protective compound of such a nature as not to have any deleterious action on the rubber or armouring, as the case may be. The finish of the braiding is to be smooth and uniform.

(*c*) Cable of higher insulation resistance than shown in **Table VII.** is not recommended for use in hot situations.

3. **Paper-insulated Cables.**—(*a*) Paper-insulated cables are to be insulated with a covering of paper impregnated with a chemically neutral insulating compound.

(*b*) The radial thickness of dielectric is not to be less than that specified in **column 3** of **Table V.**

4. **Lead Covering.**—(*a*) All cables where required to be lead covered are to be provided with a closely fitting sheath either of commercially pure lead or of an approved lead alloy. The sheath is to be of uniform thickness concentric with the conductor, free from flaws of all kinds and having a smooth exterior surface.

(*b*) The radial thickness of lead is not to be less than that specified in **column 8** of **Table IV.**, **column 4** of **Table V.**, **columns 8** to **10** of **Table X.**, **columns 4** to **7** of **Table XI.**, or **columns 4** to **9** of **Table XII.**, according to the dielectric used.

5. **Armouring.**—(*a*) Lead-covered cables where required to be armoured are to have over the lead a layer of jute yarn, hessian tape, or other suitable material, in conformity with **Table VI.**, impregnated with a moisture-resisting preservative compound. On the jute is to be bedded an armouring of annealed and galvanized steel wire; each wire is to be of the diameter specified in **columns 5** and **10** of **Table IV.**, **column 6** of **Table V.**, or **column 3** of **Table VI.** The wires are to have a uniform lay not exceeding 10 times the diameter of their pitch circle for wires exceeding 2,03 mm. diameter, and not exceeding 8 times the pitch circle diameter for smaller wires. The armouring is to be so applied as to present a uniform cylindrical exterior surface, and the overall diameter is not to exceed that specified in **column 11** of **Table IV.**, or **column 7** of **Table V.**

(*b*) Braided cables armoured without the interposition of a lead covering are to conform to the above except that the armouring is to be bedded on the braiding.

6. **Testing and Inspection.**—The prescribed tests and inspections are to be made at the place of manufacture prior to despatch and may require to be carried out under the supervision of the Surveyor; but in the event of any of the material proving unsatisfactory in the course of being installed in vessels, such material shall be rejected, notwithstanding any previous certificate of satisfactory testing.

7. **Tests of Dielectric of Cables.**—(*a*) The dielectric of cables, except flexible cords, insulated with vulcanized rubber or impregnated paper, is to be such that when the insulated conductor has been immersed in water for 24 hours it will withstand a voltage test, while still immersed, carried out with alternating current of the appropriate voltage stated below, maintained continuously at the full value for 15 minutes between conductors and between each conductor and earth. The alternating current is to be approximately sine-wave form at any frequency between 25 and 100 cycles per second.

Immersion in water for the purpose of this test may be omitted in the case of lead sheathed cables.

(i) Rubber insulated 250 volt cable—Test voltage 1000.

(ii) Rubber insulated 660 volt cable—Test voltage 2500.

(iii) Paper insulated 1,000 volt cable—Test voltage 3000.

Subsequent to such pressure test and whilst the cable is still immersed in water the insulation resistance at a temperature of 15,6° C., after one minute's electrification at a pressure of at least 500 volts, is not to be less than that given in **Table VII.**

(*b*) The insulation resistance of each insulated conductor of a multicore cable, except flexible cords, is not to be less than that given in **Table VII.** for single conductors of the same sectional area.

(*c*) The insulation resistance of the dielectric separating the two conductors of a concentric cable is not to be less than that given in **Table VII.** for single conductors having the same diameter as the inner conductor.

8. **Multicore Cables.**—Multicore cables are to be either insulated with vulcanized india-rubber or impregnated paper. The insulated cores are to be laid up in a symmetrical manner with jute wormings where required to make the cable of circular section, and be either braided, lead-covered with or without armouring as herein described in the case of single cables.

Multicore and concentric cables are to be made in accordance with the requirements of the Rules relating to the quality, dimensions and tests of single-core cables, so far as they are applicable.

The dimensions of lead covering and armouring are to be in accordance with **Tables VI., X., XI.** and **XII.**

INSTALLING AND FIXING OF CABLES.

Section 6. **1. Cable Sockets and other connections.**—(*a*) The ends of all cables having a sectional area of 4,25 mm². and above are to be provided with soldering sockets.

(*b*) Soldering fluids containing acid or other corrosive substances are not to be used.

(*c*) When soldering or securing the ends of cables to sockets or terminals, the dielectric is not to be removed farther than is necessary to allow the unreduced conductor to enter and completely fill the socket or terminal.

(*d*) The braid, lead, or other covering over the dielectric, including the tape in contact therewith, is to be cut back at least 13 mm. from the end of the dielectric.

(*e*) In the case of paper-insulated or varnished cambric-insulated cables the exposed conductor and dielectric is to be protected from moisture by being suitably sealed with insulating compound, or in an approved manner with waterproof insulating tapes.

(*f*) The ends of the stranded conductors unprovided with cable sockets are to be made solid by soldering in the case of all conductors insulated with paper, and in the case of those insulated with rubber, where the cables are fixed in damp situations.

2. Selection of Cable Runs.—(*a*) Cables are to be run as far as possible in accessible positions, so chosen that they are not exposed to drip or accumulation of water or oil, to high temperature from boilers, steam pipes, uptakes, radiators, electrical resistances or other hot objects, or to avoidable risk of mechanical damage. Cables are not to be laid under machines or floorplates, unless adequately protected to the satisfaction of the Surveyors. Cables in winch contactor houses are, as far as practicable, to be run clear of the outer casing and away from the heat of the resistances.

(*b*) The runs are to be as direct as possible and an unarmoured rubber-insulated cable is not to be bent to a shorter radius than twice its overall diameter, and an armoured rubber-insulated cable to a shorter radius than three times its overall diameter. Paper-insulated or varnished cambric-insulated cable (whether armoured or not) is not to be bent over a radius shorter than six times its overall diameter.

3. Support and Protection of Cables.—(*a*) Cables are to be securely fixed in position.

(*b*) If not exposed to risk of mechanical damage cables may be secured in one of the following ways:—Cables of all classes may be run in wood casing in dry situations. The casing may form part of ornamental woodwork provided that ready access can be had to the cables contained therein. The casing and capping are to be secured by screws, which for the capping are to be of brass, and on the outer edges only. Precautions are to be taken to ensure the separation of cables run in separate grooves where cables cross one another.

(*c*) Armoured cables and lead-covered cables, where not run in wood casing, are to be secured by metal clips having smooth or rounded edges, and effectual means are to be taken to ensure that the electrical resistance between any two points of the metallic envelopes of such cables does not exceed 2 ohms. Such clips are to be firmly secured by screws of ample strength, and are to be spaced in accordance with **Table VIII.** Armoured cables having a sectional area of 160 mm². and upwards may be carried by metal hangers instead of being secured by clips. Metal staples are not to be used for any class of cable.

(*d*) If cables are exposed to the risk of mechanical damage they are to be efficiently protected by sheet iron plating or by heavy-gauge screwed conduit. Conduits are to be electrically and mechanically continuous across all joints therein, and the entire length is to be effectually earthed. Ventilating outlets are to be provided preferably at their highest and lowest points to allow circulation of air and to ensure that no water can lodge in any part of the conduit. All open ends of conduit are to be bushed to avoid abrasion of the cable coverings and all openings are to be protected against the direct access of sea water.

(*e*) Cables in machinery spaces, galleys, laundries, bathrooms and lavatories or where unavoidably exposed to the weather or to the action of sea water are to be either lead covered with or without further protection or to be run in conduit as required by paragraph (*c*).

(*f*) Cables entering refrigerating chambers are to pass normally through the insulation of the chamber, and are to be protected by a continuous lead tube flanged over at each end.

(*g*) Cables fixed within refrigerating chambers are not to be embedded in the insulation, but are to be in full view throughout their length, and are to be supported by clips made of porcelain, hard wood, or other non-metallic and non-hygroscopic material. In all cases the cables are to be sheathed with commercially pure lead or with lead alloy, in accordance with **Section 5, clause 4.** If sheathed with

commercially pure lead they are in addition to be braided as laid down in **Section 5, clause 2** (*b*).

(*h*) Cables of opposite polarity may be bunched in conduit if carrying direct current; if carrying alternating current they are to be bunched. Where protected by wood casing, cables of the same polarity may be bunched. Lead-covered and armoured cables may in all cases be bunched, whatever their polarity.

(*i*) Every lead-covered cable, whether armoured or not, and every armoured cable, is to have its lead covering and/or armouring efficiently earthed at both ends, except in the case of such cables forming final sub-circuits, which are to be earthed at the supply end only. Effectual means are to be taken to ensure that all metallic envelopes of cables are made electrically continuous throughout their length. All earthing connections are to be effected by soldered joints or clamps, or alternatively by glands specially designed for the purpose of forming part of joint boxes or similar fittings in which cables terminate, and are to conform to the requirements of **Section 7, clause 4,** as far as they are applicable.

4. **Joints during Erection.**—(*a*) All connections between large rubber-insulated cables are to be made by means of clamped sleeves or tees in joint boxes constructed in accordance with **Section 3, clause 7,** and those between small cables and between small cables and flexibles by means of clamped connections contained within suitable receptacles, which in the case of lamp fittings may form part of such fittings. Joints in flexibles are not permissible.

(*b*) Connections between lead-covered paper-insulated or varnished cambric-insulated cables may be made by the same means as for rubber-insulated cables, the insulation at their ends being suitably sealed against moisture; or the conductors may be joined by means of copper sleeves, the whole being sweated together. Joints made in this manner are to be lapped with paper or pure cotton tape, impregnated immediately before use, and are to be enclosed in boxes, or, preferably, lead sleeves or tees wiped on to the cable coverings, these receptacles being filled with an insulating compound impervious to moisture. Lead sleeves and tees are to be painted with two coats of tough elastic enamel on completion of the joint.

5. **Watertight Glands and Deck Tubes.**—All cables passing through decks or watertight bulkheads are to be provided with deck tubes or watertight glands.

6. **Cables passing through Beams and non-Watertight Partitions.**—Unarmoured cables passing through beams and non-watertight partitions are to have the holes through which they pass bushed with lead or other soft non-ferrous material.

MAIN DISTRIBUTION.

Section 7. 1. **Subdivision of Circuits.**—(*a*) Each installation is to have its individual lamps and other devices consuming small currents grouped into circuits taking not more than 6 amperes, and the maximum number of points on each such final sub-circuit is not to exceed ten. These final sub-circuits are to radiate from a sub-distribution board.

NOTE:—A point is the termination of the wiring for attachment to a fitting for one or more lamps or other consuming devices.

(*b*) Each sub-distribution board and each lamp or other consuming device taking more than 6 amperes is to be connected to a separate way on a section or main distribution board. Each section or main distribution board in turn is to be connected either to a separate way on the main switchboard or to one way of a distribution board for larger currents, which in turn is to be connected to the main switchboard or to one way of a distribution board for still larger currents. The number of such distribution boards intervening between the final sub-distribution boards and the main switchboard will depend upon the size and disposition of the installation.

(*c*) Where three-wire distribution is employed and the pressure across the outer conductors exceeds 250 volts the pressure between any two points in one space or compartment where portable fittings, appliances or accessories are likely to be used is not to exceed 250 volts unless the fittings, appliances or accessories between which there may be a higher pressure are so situated that they cannot be brought within 1,8 metres of each other.

2. **Control of Circuits.**—(*a*) Each two-wire circuit on a distribution board whether supplied from a two-wire system, from a three-wire system with insulated neutral, from a three-phase four-wire system with insulated neutral, or from a three-phase three-wire system, is to be controlled by a fuse on each insulated pole, and, except in the case of a sub-distribution board, by a switch on one insulated pole.

(*b*) Fuses or switches are not to be connected to that pole of the circuit which is either earthed or derives its polarity from an earthed conductor.

(*c*) The neutral conductor of a three-wire system or of a three-phase four-wire system whether earthed or not, is never to be interrupted by a fuse or switch, but an isolating link may be fitted for testing purposes in the neutral or any other conductor, provided it be arranged for use by skilled persons only.

(*d*) Each three-wire circuit supplied from all three conductors of a three-phase system is to be controlled by a triple-pole circuit breaker with overload trips on at least two phases, or by a triple-pole linked switch and by a fuse on each pole.

3. **Earthing of Neutral.**—Where the distribution is effected on the three-wire system, whether with direct or alternating current, the neutral may be earthed at one or more points whatever the pressure of supply, but if the pressure exceed 250 volts (as allowed for a direct-current supply only) whether across the outer conductors of a three-wire system or on a plain two-wire system, the neutral is to be solidly and permanently earthed at one point at least ; in the latter case a neutral point is to be provided by means of static coils on the generator.

4. **Earthing Connections.**—(*a*) Each conductor used for earthing purposes which does not normally carry current, is to be of copper having the same sectional area as the working conductor, but not less than 1,94 mm². for all sizes up to 4,5 mm². Above this size a conductor of not less than 4,5 mm². is to be provided for every 50 amperes of working current or part thereof. Its sectional area need not exceed 64,5 millimetres.

(*b*) Each conductor used to carry the working current of a circuit to the ship's structure on the single-wire system of distribution is to be of the same sectional area as the corresponding conductor of the insulated portion.

(*c*) All connections to the ship's structure are to be in accessible positions.

(*d*) Solid wires are to be connected to the ship's structure by being formed into a hook and placed under a brass washer and secured by a screw of not less than 9,5 mm. diameter used for this purpose only.

(*e*) Cables are to be provided with cable sockets secured to the ship's structure by screws of not less than 9,5 mm. diameter.

(*f*) In all cases care is to be taken to ensure bright metallic surfaces at the contact areas immediately before screwing up.

5. **Two-wire Circuits supplied at Pressures exceeding 250 Volts.**—Where a pressure exceeding 250 volts (as is allowed for a direct-current supply only) is employed, the following conditions are to be observed :—

(*a*) Machines, whether generators or motors, are not to be of the open type.

(*b*) Motors only are to be supplied at such higher pressure.

(*c*) Only motors exceeding 3 brake horse-power are to be supplied at such higher pressure.

(*d*) Portable motors, whatever their size, are not to be supplied at such higher pressure.

(*e*) All metal work other than that designed to be alive is to be efficiently connected with earth.

(*f*) The wiring is to be carried out wholly with lead-covered and armoured or braided and armoured cables, and the armour (and the lead, if there be lead) is to be electrically continuous and efficiently connected with earth.

(*g*) The motors and all accessory apparatus in connection therewith are to be so constructed, enclosed and protected that there will be no danger of any shock in the ordinary handling thereof, and that the danger of fire under abnormal conditions will be reduced to a minimum.

(*h*) All switchboards are to have their live parts protected against accidental contact.

6. **Alternative Lighting.**—Alternate groups of lamps in engine and boiler-rooms are to be supplied from circuits so arranged that the fusing of any one cut-out (other than a cut-out on the main switchboard) will not leave these spaces in darkness.

7. **Emergency Supply.**—(*a*) Where the laws of the country in which the vessel is registered require an emergency supply to be provided, it is to be adequate in amount, and so disposed as to meet all requirements concerning safety imposed by the competent authority.

(*b*) The emergency circuits are to be connected direct to a change-over switch, or switches, fitted near the source of emergency supply, enabling these circuits to be quickly transferred from the ordinary to the emergency source.

8. **Interference with Magnetic Compasses.**—(*a*) Dynamos, motors, secondary batteries, control gear, resistances and all apparatus producing an external magnetic field when in use are to be fitted at such distances from the compass bowl, as will reduce the magnetic field produced by such apparatus to a negligible value thereat.

(*b*) Single-conductor circuits carrying continuous current are not to be fitted within 9,15 m. of standard and steering compasses. In order that the lead and return currents may neutralize one another in two-conductor systems, conductors in the vicinity of the compass are preferably to be twin ; if separate, they are to be fixed as close to one another as possible, and be equidistant from the compass throughout their length. Conductors within the compass binnacle are to be as short and direct as possible ; if separate, they are to be twisted together and are not to be coiled into spiral loops.

(*c*) Incandescent electric lamps employed for illumination of the compass card are not to consume more than 0,6 ampere. Such lamps are to be so placed that all live parts are at a distance of not less than 180 mm. from any part of the magnetic system of the compass.

(*d*) Careful tests are to be made during the adjustment of the compasses. The effect of switching on and off circuits, motors and other electro-magnetic apparatus within the vicinity of the compasses, is to be noted and careful records are to be kept of any errors observed, whether corrected or not.

9. **Navigation Lamps.**—(*a*) Each navigation lamp is to be separately wired and is to be controlled by a separate switch, and separate fuses which are to be double-pole unless one conductor of the system be earthed; such switches and fuses are to be grouped in a position accessible only to the officers of the watch.

(*b*) Each navigation lamp is to have an automatic indicator in its circuit placed on or adjacent to its switch and arranged to give an aural or visual signal in case of extinction of the light by breakage of the lamp filament or from other cause.

(*c*) Carbon or metal filament vacuum lamps with bayonet socket caps are to be used. The illuminating power of the lamps is to be 32 candles.

The filament is to be of the cylindrical ("squirrel cage") type. The diameter of the cage forming the filament is not to be less than 25 mm. or more than 35 mm. Double filament lamps are not to be used.

(*d*) The lamp is to be fitted in a vertical position with the cap downwards. Should the lantern be provided with a dioptric lens the luminous centre of the source of light is to coincide with the focal centre of the lens.

NOTE.—This clause does not apply in the case of tugs and similar vessels.

10. **Shore Connections.**—Where provision for a supply of electrical energy from the shore or other external source is desired, a suitable connection box or boxes is to be fitted in a position convenient for the reception of portable cables from the external source and containing terminals of ample size and of such form as to enable the conductors to be efficiently clamped therein. The terminals are to be connected to the main switchboard by suitable cables, permanently fixed, through a circuit breaker, or switch and fuses on each pole, of sizes appropriate to the proposed shore supply but not greater than the capacity of the main omnibus bars. A circuit breaker or fuses of appropriate size is, in addition, to be fitted as near as possible to the incoming supply terminals.

SECONDARY BATTERIES FOR LIGHTING AND POWER.

Section 8. 1. **Construction.**—The cells of secondary batteries are to be of such construction as to prevent spilling of the electrolyte through the motion of the ship and to prevent the emission of acid spray on surrounding objects.

The containers are to be of strong construction and of non-brittle material; they are not to be of celluloid. The plates are to be of such dimensions and so arranged that they are firmly secured against motion within the containers.

2. **Arrangement.**—Each battery is to be so arranged that a potential difference exceeding 50 volts does not exist between adjacent cells and that each cell will be readily accessible from the top and from at least one side; if possible they are to be arranged in a single tier. The cells are to be carried by glass or vitreous porcelain insulators provided with suitable channels to contain oil, and insulators of similar material, but not necessarily filled with oil, are to be employed to prevent any movement of the cells arising from motion of the ship.

3. **Position, Protection and Ventilation of Battery Compartment.**—(*a*) The position of the battery compartment is to be such that the magnetic compasses are not affected by currents in the battery or in the connections thereto.

(*b*) Where acid is used as an electrolyte for the cells, the deck below the cells is to be lined with lead or other acid-resisting material so as effectually to prevent any acid getting into contact with the structure of the ship. All metal-work within the compartment, including exposed metal on the battery and its connections, is to be protected with acid-resisting paint. All trunks or other parts exposed to acid fumes or gases are to be similarly protected.

(*c*) The compartment in which batteries are fixed is to be thoroughly well ventilated by means of supply and exhaust ventilators, independent of one another, so arranged that it will be impossible for gases to accumulate in large quantities during charge or discharge of the battery.

4. **Control.**—(*a*) Suitable means are to be provided for controlling the current with which a battery is being worked. As a minimum this is to comprise an automatic cut-in and cut-out switch and fusible cut-out, or alternatively, a circuit breaker with overload and reverse-current trips.

(*b*) Switches, fuses, and other electrical fittings, liable to cause an arc are not to be placed within the battery room, but a fuse is to be placed in each conductor immediately outside the battery room, such conductors being spaced at least

75 mm. apart on insulators in the battery room, and the holes in bulkheads or decks through which they pass being substantially and tightly bushed, a separate bush being provided for each cable.

(*c*) All connections within an acid battery room are to be either of bare metal or lead-covered cables.

FITTINGS.

Section 9. 1. **General Requirements.**—(*a*) Fittings are to be weatherproof on weather decks, in stokeholds and engine rooms, and wherever exposed to drip or condensed moisture. In spaces in which goods are liable to be stacked in close proximity to them, they are to be provided with substantial metal guards.

(*b*) Open type fittings whether fixed or portable are not to be used in spaces where

(i) Inflammable or explosive dust or gases are liable to be present or where inflammable goods are stored. In such situations lamp fittings are to be of strong construction, having air-tight external globes of thick glass, provided with substantial guards.

(ii) In positions in which the lamp is either near to, or can swing near to, readily combustible materials.

(*c*) Open type fittings are not to be furnished with combustible shades unless such shades are kept free from contact with the lamps by suitable guards or supports. Celluloid is not to be used in any situation near a lamp.

(*d*) Switches and other fittings liable to arc when operated are not to be installed in bunkers or other spaces in which inflammable or explosive dust or gases are liable to be present, whether controlling lights in such spaces or not.

(*e*) Lamp fittings installed in spaces allotted alternatively to passengers or cargo are to be of extra strong construction so designed as to admit of easy removal of lamps, globes and guards, provision being made for the protection of the base of the fitting and its lampholder after such removal by a screwed metal cover. Alternatively, the complete fitting may be protected by a strongly constructed hinged or screwed metal cover completely enclosing it. In either case the enclosure is to be such that the fitting cannot be tampered with easily. Switches and fuses controlling lights in spaces of this kind are, wherever possible, to be placed outside the spaces. Where this is impracticable they are to be contained in strong iron boxes with iron covers provided with padlocks.

(*f*) Fittings and accessories are to be so designed and insulated conductors so installed, that no stress can be applied by the conductors to any terminal to which they may be connected.

(*g*) Enclosed lamp fittings are to be suitably ventilated.

2. **Switches.**—Switches are to be constructed wholly of durable non-ignitable, non-absorbent materials.

3. **Lampholders.**—(*a*) Lampholders are to be of the Goliath type for lamps consuming more than 300 watts.

(*b*) Lampholders are to be wholly of non-ignitable material and all metal parts are to be of robust proportions. Goliath holders are to be provided with efficient means for locking the lamp in the holder.

(*c*) Lampholders in weatherproof portable fittings are to have their uninsulated metal parts in metallic contact with the frames of such fittings.

(*d*) Lampholders in open type portable fittings are to be insulated from the fitting by means of insulating material of adequate mechanical strength which will not soften at 302°F. (150° C.) and be so shielded by means of similar insulating material that they cannot be touched accidently by a person using the fitting or replacing a lamp. This shield is to be so extended as to prevent the lamp cap being touched when the lamp is in the holder.

(*e*) Small and miniature lampholders are not to be employed on systems exceeding 110 volts.

4. **Ceiling roses.**—Ceiling roses are to be of non-ignitable non-conducting non-hygroscopic material.

5. **Plugs and Sockets.**—(*a*) The live parts of plugs and sockets are to be so proportioned that their average temperature will not rise more than 30° C. above that of the surrounding air when the normal working current is flowing through them continuously.

(*b*) Watertight plugs and sockets are to be employed on weather decks, in stokeholds and engine rooms, and wherever exposed to drip or condensed moisture.

6. **Searchlight lamps.**—(*a*) Searchlight lamps are to have the whole of their live parts insulated from the frame or case.

(*b*) All parts of a searchlight lamp which have to be handled for its operation or adjustment while in use are to be insulated from the circuit with strong, non-ignitable material, of substantial proportions, and be so disposed that there is no risk of shock to the operator.

(*c*) Each searchlight circuit is to be controlled by a fuse on each insulated pole, and by a double-pole linked switch.

7. **Arc lamps.**—(*a*) Arc lamps, other than searchlight lamps, are to have the whole of their live parts insulated from the frame or case.

(*b*) Each arc lamp is to be provided with a globe or lantern arranged to intercept falling particles of carbon, and with wire netting or other means of preventing pieces of broken glass falling.

(*c*) Each arc lamp circuit is to be controlled by a fuse and switch on each insulated pole. Where more than one pole is insulated the switches are to be linked.

(*d*) Arc lamps are not to be fitted in spaces in which combustible goods are stored, or in which inflammable gases may accumulate.

HEATING AND COOKING APPLIANCES.

Section 10. 1. **General Construction.**—(*a*) All appliances are to be so constructed and mounted that their supports and those parts which have necessarily to be handled in their operation cannot become heated to a temperature exceeding 130° F. (54° C.). The heating elements are to be so arranged that they can be readily replaced.

(*b*) The high temperature parts of radiators are to be suitably guarded.

(*c*) The junction between the elements and switches or external connecting leads are to be effected without solder by suitable connections, which are to be so placed that the temperature of no part of the switch or terminal connections can rise above 176° F. (80° C.).

(*d*) All connections between elements or between elements and main terminals or switches are, unless self-supporting or rigidly fixed in position, to be continuously insulated with suitable non-ignitable material.

(*e*) All live parts of cooking appliances are to be so guarded that the cooking utensils cannot be brought into contact with them.

2. **Provision for Earthing.**—All appliances for pressures exceeding 150 volts, whether portable or fixed, are to be provided with a terminal or other suitable means for earthing all uninsulated parts and such terminals are to be efficiently connected to earth.

3. **Control.**—(*a*) All appliances are to be protected by a fuse on each insulated pole.

(*b*) Appliances whether portable or fixed are to be controlled as a whole by a switch, which in all cases is to be permanently fixed.

4. **Portable Appliances** are to be of such shape or so weighted that they cannot easily be overturned and these are to have suitable stowage positions.

5. **Protection of Inflammable Materials.**—All inflammable materials in the vicinity of heating and cooking appliances where fitted in the ship are to be protected by suitable fire-resisting materials.

6. **Air Heaters.**—(*a*) The construction of heaters is to be such as to heat the surrounding air by convection. Heaters in which the elements are caused to glow or reach such a temperature as will ignite explosive vapours, dust, etc., in the surrounding atmosphere are not to be used, except where fitted in suitable situations in public rooms.

(*b*) Heaters are to be durable and all parts should be of strong construction. The protecting guards are to be strong enough to resist being forced against any current carrying part. The openings are to be of small size to prevent the heating elements from being short-circuited or injured by accident.

(*c*) Where installed on a deck or bulkhead they are to be so mounted that there will be at least 50 mm. of air space between the heater and the deck or bulkhead. They are to have non-inflammable heat resisting material between the heater and the surface on which they are mounted or to which they are adjacent.

(*d*) Where the heaters are of the portable type a suitable clip or bracket is to be fitted for holding the heater in a fixed position.

MOTORS.

Section 11. 1. **General Construction.**—(*a*) All working parts are to be readily accessible.

(*b*) All field coils are to be self-contained and readily removable for replacement.

(*c*) Motors are to be so constructed, erected and supported that when running at any and every working speed all revolving parts are well balanced and do not give rise to any appreciable vibration.

2. **Rating of Motors.**—Motors rated at more than one brake horse-power are to conform to Appendix No. 2, except that in tropical climates or where fixed in specially hot situations on the ship, the rated full load is not to be exceeded and the temperature rise at rated full load for motors not totally enclosed is not to exceed 63° F. (35° C.) on the windings and 72° F. (40° C.) on the commutator; for totally enclosed machines, the temperature rise at full load is not

to exceed 81° F. (45° C.) on the windings and 90° F. (50° C.) on the commutators, all temperatures being measured by thermometer.

Where the temperature of the compartment is liable to exceed 120° F. (49° C.), **clause 6** (*g*) of this Section is to be complied with.

The tests on all motors engaged on essential services, such as those enumerated in **Section 18,** are to be carried out at the makers' works, and a certificate giving the results is to be submitted for approval. Machines of 100 B.H.P. and over are to be inspected by the Surveyors during manufacture and testing.

3. **Brushes.**—(*a*) The brushes are to be of carbon, and are to be provided with flexible copper connections.

(*b*) Means are to be provided for the adjustment of the brushes longitudinally, so that they may be staggered in such a manner that in multipolar machines every part of the commutator working surface will be swept by an equal number of positive and negative brushes in order to avoid unequal wear.

4. **Terminals.**—(*a*) Suitable terminals clearly marked and provided with cable sweating sockets are to be provided in an accessible position, convenient for wiring.

(*b*) The terminals are to be so spaced or shielded that they cannot be accidentally earthed, short-circuited, or touched.

(*c*) The frame of every motor is to be provided with a suitable terminal to which the earthing lead is to be connected.

5. **Lubrication.**—(*a*) Motors are to be efficiently and continuously lubricated automatically with the base of the machine inclined at any angle up to 15 degrees from the horizontal in any and every direction.

(*b*) If ring lubrication be employed, the rings are to be so constrained that they cannot leave the shaft.

(*c*) Oil flingers, or other suitable means, are to be provided to prevent the lubricant creeping along the shaft or otherwise gaining access to the insulation of the machine or any live part thereof.

(*d*) Each oil-lubricated bearing is to be provided with a suitable overflow which, while permitting efficient lubrication when the motor is running, is to prevent excess of oil.

6. **Position in Ship.**—(*a*) Motors are, wherever possible, to be placed in well-ventilated compartments in which inflammable gases cannot accumulate, and in all cases they are to be fixed clear of all inflammable material. Where these conditions cannot be complied with, motors fitted in such compartments are to be of the flame-proof or forced-draught type, with supply and exhaust pipes or ducts taken outside the compartments.

(*b*) The motors are, as far as possible, to be placed in positions in which they are not exposed to risk of mechanical injury or to damage from water, steam, or oil.

(*c*) Motors required to work under water are to be of the immersible type.

(*d*) Motors essential to the safety of the ship in the event of damage are to be so installed as to be capable of running for a reasonable period after the compartment in which they are situated has been flooded.

(*e*) In all sea-going ships, the motors are, wherever possible, to be placed with their axes of rotation in a fore and aft direction.

(*f*) Unprotected woodwork or other combustible material is not to be fitted within a distance of 0,30 m. measured horizontally from, or within 1,20 m. measured vertically above, any motor, unless it be of the totally enclosed, pipe-ventilated, induced draught, forced-draught, drip- or flame-proof type.

(*g*) Motors fitted in compartments in which the temperature is liable to exceed 120° F. (49° C.) are to be specially ventilated with air at or below that temperature, or to be constructed with Class B insulation, in accordance with Appendix No. 2, or so constructed that the final temperatures during normal working do not exceed the temperature rise permitted in Appendix No. 2 plus 40° C.

CONTROL GEAR AND RESISTANCES.

Section 12. 1. **General Construction.**—(*a*) Generator field and motor speed regulators, starters, and controllers, are to be constructed wholly of durable, non-ignitable, non-hygroscopic material, and unless otherwise guarded from approach are to be enclosed in non-ignitable cases.

(*b*) All switch parts and protective devices are to be so proportioned that their temperature will not rise more than 30° C. above that of the surrounding air, when the normal working current for which they are designed flows through them continuously.

(*c*) The contact-making faces are to be sufficiently numerous to prevent destructive arcing, and are to be readily renewable without dismantling the gear.

(*d*) Handles and their attachments are to be mechanically strong, and so designed and guarded that the hand of the operator cannot touch live metal.

(*e*) All live parts are to be enclosed by metal covers, which are to be clear of such live parts by not less than 19 mm. Those portions of the cover in proximity to working contacts are to be lined with non-ignitable insulating material.

2. **Resistances.**—(*a*) Resistances are to be so proportioned that they do not rise to such a temperature as seriously to impair their durability.

(*b*) Internal connections are not to be soldered, and all such connections, unless self-supporting or rigidly fixed in position, are to be continuously insulated with porcelain beads or other approved non-ignitable insulation.

(*c*) Suitable terminals with cable sockets are to be provided for the attachment of external leads, and are to be so situated that such leads are not exposed at any point to a high temperature.

3. **Position in Ship.**—(*a*) Control gear, wherever possible, is to be placed in positions in which inflammable gases cannot accumulate. Where such conditions cannot be complied with, such apparatus is to be flame-proof.

(*b*) Control gear, as far as possible, is to be placed in positions in which it will not be exposed to risk of mechanical injury or to damage from water, steam, or oil. Where necessarily exposed to such conditions, it is to be totally enclosed.

(*c*) All resistances are to be placed in well-ventilated compartments in which inflammable gases cannot accumulate, and in such positions as to be clear of all inflammable material. Unprotected wood-work or other combustible material is not to be fitted within a distance of 0,15 m. measured horizontally from, or within 0,60 m. measured vertically above, the frames or the cases containing them.

INTERNAL COMMUNICATIONS.

Section 13. 1. **Construction of Transforming Plant.**—Motor generators and static transformers used for the reduction of pressure for communication circuits are, together with their control gear, to be constructed in accordance with the regulations for similar plant employed for lighting and power supply.

2. **Batteries.**—Primary and secondary batteries are to be readily accessible at all times. Means are to be provided to prevent liquid from wet primary cells coming into contact with the wooden floor or framework of the ship. Secondary batteries are to be fitted in accordance with **Section 8.**

3. **Construction of Apparatus.**—All apparatus for communications is to be constructed to take the full pressure of the source of supply without the interposition of any external resistance, and, if the pressure of supply exceeds 25 volts, all circuits, switches, resistances, distribution boards and accessories required in connection therewith are to be designed and fitted throughout in all respects in accordance with the regulations for lighting and power circuits.

4. **Communication Cables.**—(*a*) Cables used for the purpose of internal communication are to be of one or other of types specified in **Section 5, clause 1,** and are to be fitted in a similar manner to cables installed for the lighting and power supply of the ship, and they are, as far as possible, to be kept separate unless the lighting and power cables are protected by one or more of the following, with or without braiding overall :—

(i) Lead covering,

(ii) Steel wire armouring,

(iii) Tough rubber sheathing.

(*b*) Communication cables run in wood casing, are not to be fixed in the same groove as cables supplying lighting and power.

5. **Protection of Circuits.**—In all cases in which secondary batteries, motor generators or static transformers are employed, the main circuit or circuits are to be protected by a fuse or fuses, but fuses need not be fitted in branch circuits if the pressure does not exceed 25 volts or in any circuit supplied from primary batteries.

LIGHTNING CONDUCTORS.

Section 14. Lightning Conductors.—(*a*) Lightning conductors are to be fitted to each mast of all wooden vessels and of steel vessels having wooden masts. They need not be fitted to steel vessels having steel masts.

(*b*) In wooden ships or ships sheathed with wood the lightning conductors are to be composed of a continuous copper tape or rope, having a section not less than 97 mm^2. which is to be riveted or clamped to a suitable copper spike attached to the mast-head. If of tape the lower end is to terminate at the point at which the shrouds leave the mast, and to be securely clamped to a copper rope of not less than 13 mm. in diameter. This copper rope is to be led down the shrouds and to be securely clamped to a galvanized iron plate not less than 0,2 m^2. in area fixed well below the light-load water-line and attached to the ship's side.

(*c*) In steel ships fitted with wooden masts the lightning conductors are to be composed of copper tape terminating in a spike, as set forth in paragraph (*b*). At the lower end this copper tape is to be securely attached to the nearest metal forming part of the hull of the ship.

(*d*) In all cases the lightning conductor is to be so run as to avoid sharp bends in the conductor.

(*e*) It is recommended that suitable means should be provided to enable ships when in dry dock to have their lightning conductors connected to an efficient earth on shore.

SPECIAL REQUIREMENTS FOR SHIPS CARRYING OIL HAVING A FLASH POINT LESS THAN 65·5° C.

Section 15. 1. **Nature of Supply.**—The pressure of supply is not to exceed the following values :—

(*a*) With direct current

(i) For power, 220 volts.

(ii) For lighting and heating, 110 volts.

(*b*) With alternating current

For all purposes, 110 volts.

2. **Switchboards.**—(*a*) Each outgoing circuit from the main switchboard and every branch circuit controlling either a junction or section fuse board is to be provided with a double-pole linked switch.

(*b*) The cases of all joint boxes, section and distribution boards are to be wholly of metal, and all cables are to enter the cases through watertight glands. Distribution boards in officers' accommodation may be constructed in accordance with **Section 3, clause 7.**

3. **Protective Covering of Cables.**—All cables are to be lead-covered or lead-covered and armoured.

4. **Distribution.**—Main distribution for direct current systems (*i.e.*, between switchboards and distribution boards, or between distribution boards and sub-distribution boards) is to be effected wholly on the two-wire two-conductor system with entirely separate cables, both insulated, for the respective poles ; no part of the system shall be earthed.

Main distribution for three phase alternating current systems is to be effected wholly with multicore cables.

5. **Fuses.**—Fuses are to be of an approved filled cartridge type.

6. **Dangerous Spaces.**—(*a*) Lamps, fittings, appliances of any kind, and wiring are not to be fitted in, or enter, any of the following dangerous spaces : oil-holds, cofferdams.

(*b*) Pump rooms may be lighted by lamps wired wholly outside the space and separated from the interior by an air-tight stout glass bowl.

(*c*) Lamps in pump-rooms, 'tween decks and spaces immediately adjoining oil-holds are to be contained in gas-tight fittings, the wiring being enclosed in gas-tight tubing. The switches controlling the lamps are to be wholly outside these spaces. The switches are in all cases to be double-pole.

(*d*) Portable lamps other than self-contained battery-fed lamps of a type approved for use in fiery mines are not to be used in dangerous spaces.

7. **Lighting and Heating.**—Circuits for supplying lighting and heating are not to be connected to any source of supply having a pressure in excess of 110 volts.

8. **Galleys.**—Cooking and heating appliances in galleys may be supplied with 220 volts direct current, provided they be wholly within the galley space and the galley be situated in an approved position well clear of inflammable gases and dangerous spaces. In other parts of the vessel the pressure of supply for cooking apparatus is not to exceed 110 volts.

SPECIAL REQUIREMENTS TO BE COMPLIED WITH WHERE THE CONSTANT CURRENT SERIES SYSTEM IS USED.

Section 16. 1. **Generators and Motors.**—(*a*) Every generator is to be provided with an automatic circuit closer so arranged as to short-circuit the generator in the event of an open circuit occurring at any point in the system.

(*b*) Generators or motors are not to be of the open type.

2. **Bare Conductors.**—All bare conductors (including radiator elements) are to be totally enclosed in metal cases and all access doors or covers so interlocked that the conductors contained therein will be accessible only when entirely disconnected from the system.

3. **Switches.**—(*a*) The movement of all switches is to be effected without breaking the main circuit.

(*b*) When a current consuming device is "switched-off" by its main switch it shall be totally disconnected on both poles from the system.

4. **Earthing.**—No part of the system is to be earthed.

TRIALS.

Section 17.—Before the installation is put into service the following tests are to be carried out :—

1. **Insulation Resistance.**—(*a*) The insulation resistance is to be measured by applying a direct-current pressure not less than twice the working pressure between earth and the whole system of conductors and any section thereof, with all lamps and fuses in place, and all switches on.

(*b*) The insulation resistance of the lighting circuits so measured is not to be less in megohms than 10 divided by the number of points on those circuits, except that the insulation resistance of any final lighting sub-circuit need not exceed 1 megohm.

(*c*) The insulation resistance between the case or framework and every live part of each individual dynamo, motor, heater, arc lamp or other appliance, complete with its switch and control gear, regulating resistance and similar accessories, is not to be less than half a megohm.

2. **Running Order.**—All generators are to be run in turn or simultaneously; all main switches and current breakers are to be operated, and all lamps, heaters, motors and other appliances run, though not necessarily under full load or simultaneously. During this test everything is to operate satisfactorily, and the specified drop in pressure on any part of the installation is not to exceed that laid down in **Section 4, clause 4.**

This trial is to be in addition to, and not in substitution for, the acceptance trials of the individual items of plant at the makers' works.

SPARE GEAR.

Section 18. In vessels engaged on open sea service, the articles mentioned in the following list (so far as they are applicable) will be required to be carried, viz. :—

For the Generators.

For each size of generator :—

2 brush holders.
1 set of carbon brushes for one machine.
1 set of any special spanners required.

For the Motors.

For each size of motor engaged on essential services, such as those enumerated below :—

2 brush holders.
1 set of carbon brushes for one machine.
1 set of any special spanners required.

The following are motors for which spare gear is required :—

Auxiliary compressors.
Scavenge blowers.
Cooling water pumps for main engines.
Oil fuel pumps.
Oil separators.
Fans for forced draught to boilers.
Condenser circulating pumps.
Air pumps.
Feed water pumps.
Fire pumps.
Bilge pumps.
Steering gear.
Windlasses.
Ventilating fans for engine room and boiler rooms.

For the Steering Gear.

For each size of steering gear motor and motor-generator, if no standby machine is installed, the following spare gear is required in addition to the spares for motors enumerated above.

1 spare armature of each size fitted, complete with shaft and half coupling.
1 spare field coil of each type fitted.

Where electric steering gear is fitted and there is no standby generator, similar spare gear is also to be provided for the generator.

For the Control Gear.

For the starting gear of motors, such as those enumerated above :—

1 set of contacts subject to burning or wear.
1 set of springs.
10 per cent of each different resistance element, but at least one of each.
1 of each type of coil used for contactors, relays or low voltage release.

For six or less starters in which these parts are interchangeable it will be sufficient to provide one set of spares for the starter employing the greatest number of parts.

For the Switchgear and Distribution Boards.

For each type of circuit breaker on each pole :—

1 set of contacts which are liable to be burnt or worn.
1 set of parts subject to wear.
1 set of springs.
1 shunt trip coil and 1 resistance element, of each kind used.
10 per cent but not less than 12 of each type of cartridge or other non-rewirable fusible cut-out.
2 fuse-handles of each type and size used.

For the Navigating and Signal Lights, and their pilot lamps for indicating devices :—

1 complete spare set of lamps.

Emergency Lighting.

Where this is supplied from storage batteries of a voltage different from the ship's circuit :—

1 complete spare set of lamps.

Insulation Tester.

It is recommended that a 500 volt insulation tester be provided with all equipment of 100 kw. and above for the testing of insulation and tracing of faults and that all parts of the system be periodically tested and the results recorded.

PERIODICAL SURVEYS.

Section 19. The periodical surveys of Electrical Equipment are detailed on page 23.

By order of the Committee,
MALCOLM K. SCOTT,
Secretary.

71, Fenchurch Street, London, E.C.3.
8th April, 1937.

TABLE I.

Current-carrying Capacity (subject to voltage drop) and Corresponding Fall of Pressure—Single Cables.

Nominal Area of Conductor.	Effective Area of Conductor.	Number and Diameter (in millimetres) of Wires comprising Conductor.	Insulated with Rubber.		Insulated with Paper.		Insulated with Varnished Cambric.	
			Maximum Permissible Current.	Approx. length (lead plus return) giving 1 volt drop with Current (Col. 4)	Maximum Permissible Current.	Approx. length (lead plus return) giving 1 volt drop with Current (Col. 6)	Maximum Permissible Current.	Approx. Length (lead plus return) giving 1 volt drop with current (Col. 8).
1.	2.	3.	4.	5.	6.	7.	8.	9.
mm.²	mm.²		amps.	Metres.	amps.	Metres.	amps.	Metres.
0,65	0,66	1—0,90	4,1	9,15	4,1	9,15	—	—
0,97	0,98	1—1,10	6,1	9,15	6,1	9,15	—	—
1,30	1,25	3—0,75	7,8	9,15	7,8	9,15	—	—
1,95	1,93	3—0,90	12,0	8,85	12,0	8,85	10,8	10,67
1,95	2,08	1—1,60	12,9	8,85	12,9	8,85	11,6	10,67
2,90	2,94	7—0,75	18,2	8,55	18,2	8,55	16,4	10,67
4,50	4,52	7—0,90	24,0	10,05	28,0	8,25	25,0	10,67
6,45	6,75	7—1,10	31,0	11,90	42,0	8,25	38,0	10,36
9,35	9,45	7—1,30	37,0	13,70	57,0	8,55	51,0	10,97
14,50	14,25	7—1,60	46,0	16,80	75,0	9,75	68,0	12,5
19,40	18,30	19—1,10	53,0	18,60	87,0	10,70	78,0	13,71
25,80	25,60	19—1,30	64,0	21,70	104,0	12,50	94,0	16,15
38,70	38,70	19—1,60	83,0	25,30	135,0	14,65	122,0	18,9
48,50	49,00	19—1,85	97,0	27,50	157,0	15,85	141,0	20,72
64,50	65,00	19—2,10	118,0	29,90	191,0	17,40	172,0	22,25
77,50	75,30	37—1,60	130,0	31,40	210,0	18,30	189,0	23,77
97,00	95,40	37—1,85	152,0	34,20	246,0	19,80	222,0	25,3
129,00	127,00	37—2,10	184,0	37,50	296,0	21,90	266,0	28,04
161,00	159,00	37—2,35	214,0	40,20	343,0	23,80	309,0	30,48
194,00	195,00	37—2,60	240,0	44,20	385,0	25,90	346,0	33,22
258,00	262,00	61—2,35	288,0	49,50	464,0	29,00	417,0	37,18
322,00	321,00	61—2,60	332,0	52,50	540,0	30,50	486,0	39,01
387,00	391,00	91—2,35	384,0	55,10	624,0	32,00	561,0	41,14
485,00	480,00	91—2,60	461,0	56,40	738,0	33,20	664,0	42,67
548,00	546,00	127—2,35	512,0	57,90	815,0	35,40	733,0	43,89
645,00	670,00	127—2,60	595,0	61,00	932,0	36,90	839,0	46,32

Lloyd's Register of Shipping, London.—*26th October*, 1933.

TABLE II.

Twin Flexible Cords and Cables. Current-carrying Capacity and Corresponding Fall of Pressure.

Nominal Area of Conductor. 1.	Number and Diameter of Strands in tenths of a millimetre. 2.	Maximum Current Permissible (subject to voltage drop). 3.	Approximate length (lead plus return) giving 1 volt drop with Current (Col. 3) 4.
mm.²	No. $\frac{mm.}{10}$	amps.	Metres.
0,39	14—1,90	1,8	18
0,65	23—1,90	3,0	18
1,10	40—1,90	5,0	17,4
1,95	70—1,90	8,5	17,4
3,10	110—1,90	13,0	17,1
4,50	162—1,90	17,0	21,0

TABLE III.

Intermittent Working. Current-carrying Capacity for Single Cables.

Nominal Area of Conductor. 1.	Insulated with Rubber. Half-hour Rating. 2.	Insulated with Rubber. One-hour Rating. 3.	Insulated with Rubber. Continuous Rating as in Table I. 4.	Insulated with Paper. Half-hour Rating. 5.	Insulated with Paper. One-hour Rating. 6.	Insulated with Paper. Continuous Rating as in Table I. 7.	Insulated with Varnished Cambric. Half-hour Rating. 8.	Insulated with Varnished Cambric. One hour Rating. 9.	Insulated with Varnished Cambric. Continuous Rating as in Table I. 10.
mm.²	amps.	amps.	amps.	amps.	amps.	amps.	amps.	amps.	amps.
9,35	38	37	37	60	57	57	54	51	51
14,50	47	46	46	79	75	75	71	68	68
19,40	56	54	53	94	89	87	84	80	78
25,80	68	65	64	113	105	104	102	95	94
38,70	92	85	83	151	138	135	136	124	122
48,50	113	101	97	180	162	157	162	146	141
64,50	142	124	118	225	199	191	203	179	172
77,50	160	138	130	252	220	210	226	198	189
97,00	191	164	152	303	261	246	273	235	222
129,00	247	204	184	376	320	296	338	288	266
161,00	295	244	214	453	377	343	407	340	309
194,00	351	283	240	523	435	385	470	392	346
258,00	452	357	288	663	543	464	596	488	417
322,00	534	422	332	804	648	540	723	584	486
387,00	641	499	384	960	767	624	864	690	561
485,00	774	604	461	1,180	930	738	1,061	838	664
548,00	900	680	512	1,325	1,045	815	1,190	940	733
645,00	1,036	803	595	1,548	1,211	932	1,390	1,090	839

Lloyd's Register of Shipping, London.—26*th October*, 1933.

TABLE IV.

Dimensions of Single-Core Cables—Rubber Insulated.

For pressures not varying from the potential of the ship's hull by more than 250 volts.

Conductors.		Dielectric.	Braided Cables.	Braided and Armoured Cables.			Lead-covered Cables.		Lead-covered and Armoured Cables.		
Nominal Area.	Overall Diameter.	Minimum Thickness.	Overall Diameter.	Diameter of Armouring Wire.	Diameter over Armour.	Diameter over Armour and Braiding.	Minimum Thickness of Lead.	Diameter over Lead.	Diameter of Armouring Wire.	Diameter over Armour.	Diameter over Armour and Braiding.
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
mm.²	Millimetres.	Millimetres.	Millimetres.	Millimetres.	Millimetres.	Millimetres.	Millimetres.	Millimetres.	Millimetres.	Millimetres.	Millimetres.
0,65	0,91	0,865	4,18	1,62	8,35	10,60	1,00	5,10	1,62	10,35	12,65
0,97	1,10	0,865	4,40	1,62	8,55	10,80	1,00	5,30	1,62	10,60	12,85
1,30	1,60	0,915	4,95	1,62	9,10	11,35	1,00	5,85	1,62	11,10	13,40
1,95	2,00	0,965	5,45	1,62	9,60	11,90	1,00	6,35	1,62	11,60	13,90
1,95	1,63	0,915	5,00	1,62	9,15	11,40	1,00	5,90	1,62	11,20	13,45
2,90	2,20	0,990	5,75	1,62	9,90	12,15	1,00	6,62	1,62	11,90	14,20
4,50	2,75	1,040	6,58	1,62	10,75	13,00	1,27	8,00	1,62	13,25	15,55
6,45	3,35	1,090	7,30	1,62	11,40	13,70	1,27	8,70	1,62	14,00	16,25
9,35	4,00	1,170	8,05	1,62	12,20	14,50	1,52	9,95	1,62	15,20	17,50
14,50	4,90	1,245	9,10	1,62	13,25	15,55	1,52	11,00	1,83	17,70	20,00
19,40	5,60	1,320	10,00	1,62	14,10	16,40	1,52	11,90	1,83	18,60	20,90
25,80	6,60	1,420	11,20	1,62	15,30	17,60	1,52	13,10	1,83	19,80	22,10
38,70	8,15	1,575	13,00	1,83	18,60	20,90	1,78	15,45	1,83	22,20	24,40
48,50	9,15	1,680	15,10	1,83	19,80	22,10	1,78	16,70	1,83	23,40	25,70
64,50	10,50	1,830	16,80	1,83	21,50	23,80	1,78	18,40	1,83	25,10	27,30
77,50	11,40	1,900	17,80	1,83	22,50	24,80	1,78	19,40	1,83	26,00	29,10
97,00	12,80	2,030	19,50	1,83	24,20	26,50	2,03	21,60	2,03	30,60	33,80
129,00	14,75	2,240	22,60	1,83	26,80	29,80	2,03	24,10	2,03	33,20	36,30
161,00	16,50	2,410	24,70	2,03	31,30	34,40	2,28	26,80	2,65	37,10	40,20
193,00	18,30	2,590	26,80	2,03	33,40	36,50	2,28	28,80	2,65	39,20	42,30
258,00	21,30	2,900	30,40	2,65	38,20	41,30	2,54	33,00	2,65	43,30	46,40
322,00	23,60	3,080	33,00	2,65	40,80	44,00	2,80	36,10	3,25	47,70	50,60
387,00	26,00	3,180	36,20	3,25	44,80	47,80	2,80	38,80	3,25	50,40	53,50
485,00	28,80	3,330	39,30	3,25	47,80	51,00	3,05	42,30	4,06	55,40	58,50
548,00	30,70	3,430	41,40	3,25	50,00	53,00	3,05	44,50	4,06	57,70	60,70
645,00	34,00	3,580	45,00	3,25	55,20	58,20	3,05	48,10	4,06	61,20	64,30

Lloyd's Register of Shipping, London—26*th October*, 1933.

TABLE V.

Dimensions of Cables—1000 Volt Paper Insulated or Varnished Cambric Insulated.

Conductors.		Di-electric.	Single-core. Lead-covered Cables.		Single-core, Lead-covered and Armoured Cables (Single-wire Armouring).	
Nominal Area. 1.	Overall Diameter. 2.	Minimum Thickness. 3.	Minim'm Thickness of Lead. 4.	Diameter over Lead. 5.	Diameter of armouring wire. 6.	Diameter over Armour. 7.
mm.²	mm.	mm.	mm.	mm.	mm.	mm.
0,97	1,10	1,78	1,52	7,7	1,62	14,0
1,30	1,60	1,78	1,52	8,2	1,62	14,5
1,95	2,00	1,78	1,52	8,6	1,62	14,9
1,95	1,63	1,78	1,52	8,2	1,62	14,5
2,90	2,20	1,78	1,52	8,8	1,62	15,1
4,50	2,75	1,78	1,52	9,35	1,62	15,6
6,45	3,35	1,78	1,52	9,95	1,62	16,2
9,35	4,00	1,78	1,52	10,6	1,83	17,3
14,50	4,90	1,78	1,52	11,5	1,83	18,2
19,40	5,60	1,78	1,52	12,2	1,83	18,9
25,80	6,60	1,78	1,52	13,2	1,83	19,9
38,70	8,15	1,78	1,52	14,7	1,83	21,4
48,50	9,15	1,78	1,52	15,7	1,83	22,5
64,50	10,50	1,78	1,52	17,1	1,83	23,9
77,50	11,40	1,78	1,52	18,0	1,83	24,7
97,00	12,80	1,78	1,78	19,9	1,83	26,6
129,00	14,75	1,78	1,78	21,9	2,03	31,0
161,00	16,50	2,03	1,78	24,2	2,03	33,2
194,00	18,30	2,03	2,03	26,4	2,03	35,6
258,00	21,30	2,29	2,03	29,9	2,65	40,3
322,00	23,60	2,29	2,03	32,2	2,65	42,5
387,00	26,00	2,29	2,29	35,2	3,25	46,7
485,00	28,80	2,54	2,29	38,4	3,25	50,0
548,00	30,70	2,54	2,54	41,0	3,25	52,3
645,00	34,00	2,54	2,54	44,2	3,25	55,8

TABLE VI.

Sizes of Galvanized Steel Wires and Thicknesses of Bedding for Single Wire Armouring.

Diameter of Cable to be Armoured exclusive of Bedding.		Diameter of Galvanized Steel Wire.	Thickness of Bedding.	Type of Bedding to be used.
Above. 1.	Up to and including. 2.	3.	4.	5.
mm.	mm.	mm.	mm.	
—	10	1,60	1,00	Two coats of hessian tape.
10	20	1,85	1,52	Two coats of hessian tape or two coats of jute yarn.
20	27	2,03	2,54	Three coats of hessian tape or two coats of jute yarn.
27	33	2,65	2,54	
33	89	3,25	2,54	
89	—	4,06	2,54	

Lloyd's Register of Shipping, London.—21*st June*, 1934.

TABLE VII.

Insulation Resistance of Rubber Insulated Cables.

Nominal Area of Cable.	Minimum Insulation Resistance in Megohms for a kilometre length at 15,6° C.		Nominal Area of Cable.	Minimum Insulation Resistance in Megohms for a kilometre length at 15,6° C.	
	965 megohm Grade.	4000 megohm Grade.		965 megohm Grade.	4000 megohm Grade.
mm.²			mm².		
0,65	3220	8060	48,50	965	4830
0,97	3220	8060	64,50	965	4830
1,30	2010	7250	77,50	965	4830
1,95	2010	7250	97,00	965	4830
1,95	3220	8060	129,00	965	4025
2,90	2010	7250	161,00	965	4025
4,50	1450	6440	194,00	965	4025
6,45	1450	6440	258,00	965	4025
9,35	1450	6440	322,00	965	4025
14,50	1450	5630	387,00	965	4025
19,40	1210	5630	485,00	965	4025
25,80	1210	4830	548,00	965	4025
38,70	1210	4830	645,00	965	4025

TABLE VIII.

Maximum Spacing of Clips securing Lead-covered or Armoured Cables.

Overall Diameter of Cable.	Lead-covered.	Armoured.
	Millimetres.	Millimetres.
Under 7,6 mm.	200	250
7,6 mm. and under 12,7 mm.	250	300
12,7 „ „ 19 „	300	350
19 „ „ 32 „	350	400
32 „ and above	400	450

Lloyd's Register of Shipping, London.—24*th April*, 1930.

TABLE IX.

Approximate Fusing Currents of Wires in Free Air.

Diameter of Wire.	Copper.		Lead-Tin Alloy. (Lead 75 % Tin 25 %.)	
	Fusing Current.	Maximum Safe Working Current.	Fusing Current.	Maximum Safe Working Current.
1.	2.	3.	4.	5.
mm.	amperes.	amperes.	amperes.	amperes.
0,23	8,6	4,3	—	—
0,25	9,8	4,9	—	—
0,27	11,0	5,5	—	—
0,31	12,8	6,4	—	—
0,32	13,5	6,8	—	—
0,38	17	8,6	—	—
0,46	22	11	—	—
0,51	—	—	3	2,0
0,56	30	15	3,5	2,3
0,61	—	—	4	2,6
0,71	41	21	5	3,3
0,81	—	—	6	4,1
0,74	43	22	—	—
0,92	62	31	7	4,8
1,02	73	37	—	—
1,10	86	43	—	—
1,22	98	49	10	7,0
1,32	111	56	—	—
1,42	125	63	—	—
1,63	156	78	16	11,0
1,83	191	96	—	—
2,03	229	115	—	—

Note.—The value given in the Tables may be taken to be correct where the fuse wire passes through an asbestos tube and does not closely touch the tube, but they do not apply where a substantial length of the wire is in contact with a porcelain holder.

Lloyd's Register of Shipping, London.—26*th October*, 1933.

TABLE X.

Dimensions of Tough Rubber Sheathed Cables and Thicknesses of Lead Sheathing for Multicore Rubber Insulated Cables.

For pressures not varying from the potential of the ship's hull by more than 250 volts.
Thicknesses of Dielectric, Lead Sheathing and Tough Rubber Compound.*

Nominal Area of Conductor	Number and Diameter(in millimetres) of Wires comprising Conductor.	D. Minimum Thickness of Dielectric.	Minimum Thickness of Tough Rubber Sheath.				Minimum Thickness of Lead.		
			Single.	Twin (Circular)	Twin (Flat).	Three-core.	Concentric.	Twin (flat or round).	Three† core
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
mm².		mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
0,65	1/0,92	0,87	1,27	1,27	1,27	1,27	1,00	1,00	1,27
0,97	1/1,10	0,87	1,27	1,27	1,27	1,27	1,00	1,00	1,27
1,30	3/0,74	0,92	1,27	1,52	1,52	1,52	1,00	1,00	1,27
1,95	3/0,92	0,96	1,27	1,52	1,52	1,52	1,00	1,00	1,27
1,95	1/1,63	0,92	1,27	1,52	1,52	1,52	1,00	1,00	1,27
2,90	7/0,74	0,99	1,27	1,52	1,52	1,52	1,27	1,27	1,52
4,50	7/0,92	1,04	1,27	1,52	1,52	1,52	1,27	1,27	1,52
6,45	7/1,10	1,09	1,27	1,52	1,52	1,52	1,27	1,27	1,78
9,35	7/1,32	1,17	1,27	1,52	1,52	2,03	1,52	1,52	1,78
14,50	7/1,63	1,25	1,52	2,03	2,03	2,03	1,52	1,52	1,78
19,40	19/1,10	1,32	1,52	2,03	2,03	2,03	1,78	1,78	2,03
25,80	19/1,32	1,42	1,52	2,54	2,54	2,54	2,03	2,03	2,28
38,70	19/1,63	1,58	1,52	2,54	2,54	2,54	2,03	2,03	2,28
48,50	19/1,83	1,68	1,52	2,54	2,54	3,05	2,03	2,03	2,28
64,50	19/2,11	1,83	2,03	3,05	3,05	3,05	2,28	2,28	2,54
77,50	37/1,63	1,91	2,03	3,05	3,05	3,30	2,28	2,28	2,54
97,60	37/1,83	2,03	2,03	3,30	3,30	3,30	2,28	2,28	2,54
129,00	37/2,11	2,24	2,54	3,81	3,81	3,81	2,54	2,54	2,80
161,00	37/2,36	2,41	2,54	3,81	—	4,45	2,80	2,80	3,05
194,00	37/2,62	2,59	2,54	4,45	—	4,45	3,05	3,05	3,30
258,00	61/2,35	2,90	3,05	5,08	—	5,72	3,30	3,30	3,55
322,00	61/2,62	3,07	3,05	5,72	—	6,35	3,55	3,55	3,81
387,00	91/2,35	3,18	3,30	6,35	—	6,35	—	—	—
485,00	91/2,62	3,33	3,30	6,35	—	6,35	—	—	—
548,00	127/2,35	3,43	3,30	6,35	—	6,35	—	—	—
645,00	127/2,62	3,58	3,81	6,35	—	6,35	—	—	—

* Thicknesses of Tapes and Braids are not included.

† The thickness of lead on Multicore Cables in the case where the Conductors are not of equal area is to be the same as the thickness of lead in a similar Cable having all Conductors of the same area as that of the largest Conductor in the Cable where the Conductors are unequal.

D is the thickness of the dielectric as follows:—

(1) On the Conductor of Single Conductor Cables.

(2) On each Conductor of Concentric Cables.

(3) On each core of Twin and Three-core Cables.

Lloyd's Register of Shipping, London.—21*st June*, 1934.

TABLE XI.

Dimensions of 660 Volt Cables—Rubber Insulated.

For pressures not varying from the potential of the ship's hull by more than 660 volts.

Thicknesses of dielectric, lead sheathing and tough rubber compound.*

Nominal Area of Conductor. 1.	Number and Diameter of Wires comprising Conductor. 2.	D. Minimum Thickness of Dielectric. 3.	Minimum Thickness of Lead.				Minimum Thickness of Tough Rubber Compound.			
			Single. 4.	Concentric. 5.	Twin. 6.	Three† Core. 7.	Single. 8.	Twin (Circular). 9.	Twin (Flat). 10.	Three Core. 11.
mm².	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
0,65	1–0,90	1,39	1,27	1,27	1,27	1,52	1,27	1,52	1,52	1,52
0,97	1–1,10	1,39	1,27	1,27	1,27	1,52	1,27	1,52	1,52	1,52
1,30	3–0,75	1,42	1,27	1,27	1,27	1,52	1,27	1,52	1,52	1,52
1,95	3–0,90	1,44	1,27	1,27	1,27	1,52	1,27	1,52	1,52	1,52
1,95	1–1,60	1,44	1,27	1,27	1,27	1,52	1,27	1,52	1,52	1,52
2,90	7–0,75	1,47	1,27	1,52	1,52	1,78	1,27	1,52	1,52	1,52
4,50	7–0,90	1,50	1,52	1,52	1,52	1,78	1,27	1,52	1,52	1,52
6,45	7–1,10	1,52	1,52	1,52	1,52	2,03	1,52	2,03	2,03	2,03
9,35	7–1,30	1,55	1,52	1,78	1,78	2,03	1,52	2,03	2,03	2,03
14,50	7–1,60	1,57	1,52	1,78	1,78	2,03	1,52	2,03	2,03	2,03
19,40	19–1,10	1,57	1,52	1,78	1,78	2,03	1,52	2,03	2,03	2,03
25,80	19–1,30	1,60	1,52	2,03	2,03	2,28	1,52	2,54	2,54	2,54
38,70	19–1,60	1,65	1,78	2,03	2,03	2,28	1,52	2,54	2,54	2,54
48,50	19–1,85	1,68	1,78	2,03	2,03	2,28	1,52	2,54	2,54	3,05
64,50	19–2,10	1,83	1,78	2,28	2,28	2,54	2,03	3,05	3,05	3,05
77,50	37–1,60	1,90	1,78	2,28	2,28	2,54	2,03	3,05	3,05	3,30
97,00	37–1,85	2,03	2,03	2,28	2,28	2,54	2,03	3,30	3,30	3,30
129,00	37–2,10	2,24	2,03	2,54	2,54	2,80	2,54	3,81	3,81	3,81
161,00	37–2,35	2,41	2,28	2,80	2,80	3,05	2,54	3,81	—	4,45
194,00	37–2,60	2,59	2,28	3,05	3,05	3,30	2,54	4,45	—	4,45
258,00	61–2,35	2,90	2,54	3,30	3,30	3,55	3,05	5,08	—	5,72
322,00	61–2,60	3,08	2,54	3,55	3,55	3,81	3,05	5,72	—	6,35
387,00	91–2,35	3,18	2,54	—	—	—	3,30	6,35	—	6,35
485,00	91–2,60	3,33	3,05	—	—	—	3,30	6,35	—	6,35
548,00	127–2,35	3,43	3,05	—	—	—	3,30	6,35	—	6,35
645,00	127–2,60	3,58	3,05	—	—	—	3,81	6,35	—	6,35

* Thicknesses of Tapes and Braids are not included.

† The thickness of lead on Multicore Cables in the case where the Conductors are not of equal area is to be the same as the thickness of lead in a similar Cable having all Conductors of the same area as that of the largest Conductor in the Cable where the Conductors are unequal.

D is the thickness of the dielectric as follows:—

(1) On the Conductor of single Conductor Cables.

(2) On each Conductor of Concentric Cables.

(3) On each core of Twin and Three-Core Cables.

Lloyd's Register of Shipping, London.—21*st June*, 1934.

TABLE XII.

Dimensions of Multicore Cables—Paper Insulated or Varnished Cambric Insulated. Thicknesses of Dielectric and Lead Sheath.

For pressures not varying from the potential of the ship's hull by more than 1,000 volts.

Nominal Area of Conductor.	Number and Diameter of Wires comprising Conductor.	D. Minimum Thickness of Dielectric.	Minimum Thickness of Lead.					
			Twin.		Three Core.		Four Core.	
			Circular Conductors.	Shaped Conductors.	Circular Conductors.	Shaped Conductors.	Circular Conductors.	Shaped Conductors.
1.	2.	3.	4	5.	6.	7.	8.	9.
mm².	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
4,50	7/0,92	1,78	1,52	—	1,52	—	1,52	—
6,45	7/1,10	1,78	1,52	—	1,52	—	1,52	—
9,35	7/1,32	1,78	1,52	1,52	1,52	—	1,52	—
14,50	7/1,63	1,78	1,52	1,52	1,52	1,52	1,52	1,52
19,40	19/1,10	1,78	1,52	1,52	1,52	1,52	1,52	1,52
25,80	19/1,32	1,78	1,52	1,52	1,52	1,52	1,78	1,52
38,70	19/1,63	1,78	1,78	1,52	1,78	1,52	1,78	1,78
48,50	19/1,83	1,78	1,78	1,52	1,78	1,52	2,03	1,78
64,50	19/2,11	1,78	1,78	1,52	2,03	1,78	2,03	2,03
77,50	37/1,63	1,78	2,03	1,52	2,03	1,78	2,03	2,03
97,00	37/1,83	1,78	2,03	1,78	2,03	1,78	2,28	2,03
129,00	37/2,11	1,78	2,28	1,78	2,28	2,03	2,54	2,28
161,00	37/2,36	2,03	2,28	2,03	2,54	2,28	2,54	2,54
194,00	37/2,62	2,03	2,54	2,03	2,54	2,28	2,80	2,54
258,00	61/2,35	2,28	2,80	2,28	2,80	2,54	3,05	2,80
322,00	61/2,62	2,28	3,05	2,28	3,05	2,54	3,30	3,05
387,00	91/2,35	2,28	3,05	2,54	3,30	3,05	3,55	3,30
485,00	91/2,62	2,54	3,30	2,80	3,55	3,30	3,81	3,55
548,00	127/2,35	2,54	3,55	3,05	3,81	3,30	4,07	3,81
645,00	127/2,62	2,54	3,81	3,30	3,81	3,55	4,32	4,07

D is the thickness of dielectric between any one Conductor and the next Conductor or the Lead Sheath.

The thickness of sheath on Multicore Cables in the case where the Conductors are *not of equal area* is to be the same as the thickness of sheath in a similar Cable having all Conductors of the same area as that of the largest Conductor in the Cable.

Lloyd's Register of Shipping, London.—21*st June*, 1934.

TABLE XIII.

Dimensions of 3300 Volt Paper Insulated or Varnished Cambric Insulated Cables.

Thicknesses of Dielectric and Lead Sheath.

Nominal Area of Conductor.	D. Minimum Thickness of Dielectric.	Minimum Thickness of Lead.					
		Single Core.	Concentric.	Twin.		Three Core.	
				Circular Conductors.	Shaped Conductors.	Circular Conductors.	Shaped Conductors.
1.	2.	3.	4.	5.	6.	7.	8.
mm².	mm.	mm.	mm.	mm.	mm.	mm.	mm.
14,50	2,80	1,52	1,52	1,52	1,52	1,52	1,52
19,40	2,80	1,52	1,52	1,52	1,52	1,52	1,52
25,80	2,80	1,52	1,52	1,78	1,52	1,78	1,52
38,70	2,80	1,52	1,78	1,78	1,52	1,78	1,78
48,50	2,80	1,52	1,78	1,78	1,78	2,03	1,78
64,50	2,80	1,78	1,78	2,03	1,78	2,03	1,78
97,00	2,80	1,78	2,03	2,03	1,78	2,28	2,03
129,00	2,80	1,78	2,03	2,28	2,03	2,28	2,03
161,00	2,80	2,03	2,03	2,54	2,03	2,54	2,28
194,00	2,80	2,03	2,28	2,54	2,03	2,80	2,28
258,00	3,05	2,03	2,28	2,80	2,28	3,05	2,54
322,00	3,30	2,28	2,54	3,05	2,54	3,30	2,80
387,00	3,55	2,28	—	—	—	—	—
485,00	3,81	2,54	—	—	—	—	—

D is the thickness of the dielectric as follows:—

(1) Single-Core Cables: Between the Conductor and Lead sheath.

(2) Concentric Cables: Between the Conductors and between the outer Conductor and Lead Sheath.

(3) Twin Cables: Between the Conductors and between any Conductor and Lead Sheath.

(4) Three-Core Cables: Between the Conductors and between any Conductor and Lead Sheath.

Lloyd's Register of Shipping, London.—21*st June*, 1934.

APPENDICES NOS. 1, 2, 3 AND 4 IN CONNECTION WITH THE RULES FOR ELECTRICAL EQUIPMENT AND ELECTRIC PROPELLING MACHINERY.

APPENDIX 1.

BUS-BARS AND CONNECTIONS.

1. **Material.**—The metal used is to be in accordance with the following requirements ;—

(*a*) COPPER. The conductivity of annealed copper is to be not less than 99,25 per cent, and medium hard and hard copper not less than 95 per cent of that standardised by the International Electrotechnical Commission (Publication No. 28).

(*b*) ALUMINIUM. The conductivity of aluminium is to be not less than 60 per cent of that standardised by the International Electrotechnical Commission for annealed copper.

The metal is to have a bright, smooth finish free from seams, cracks and other imperfections.

2. **Joints.**—All joints between copper conductors are to be made after tinning or coating with petroleum jelly, or have equally effective treatment for preventing deterioration of the joint.

All joints between aluminium conductors are to be made after the surfaces have been lightly coated with petroleum jelly and then scratch brushed, the joints being clamped together with the petroleum jelly still in position, or to have equally effective treatment for preventing deterioration of the joint.

In the case of joints between copper and aluminium, provision is to be made for the prevention of electrolytic action which takes place between the two metals in contact in the presence of moisture, either by the exclusion of moisture from the joint, or by the introduction of a suitable bi-metallic connector or its equivalent.

All joints, whether soldered or not, are to have the parts mechanically secured together.

3. **Limits of Temperature.**—The following temperature limitations measured by thermometer, are to apply to bare conductors in contact with air, when carrying their rated current continuously :—

CONDUCTORS RATED 2000 AMPS. AND BELOW :—
Maximum temperature 70° C. (158° F.).

CONDUCTORS RATED ABOVE 2000 AMPS. :—
Maximum temperature 80° C. (176° F.).

NOTE :—See also **Section 3, clause 2** (*i*) of the **Rules for Electrical Equipment** and **Section 8, clause 2** (*f*) of the **Rules for Electric Propelling Machinery.**

4. **Thermal Expansion.**—Where necessary, provision is to be made to allow for expansion and contraction due to temperature variations.

5. **Clearance Distances.** — The clearance distances specified below apply only to bus-bars having no insulation covering other than the surrounding air, compound or oil. Bus-bars and their connections are to be spaced in accordance with the following clearance distances :—

Max. Rated Voltage between Phases or Poles.	Minimum Clearance to Earth.		Minimum Clearance between Phases or Poles.	
	In Air.	In Oil or Compound.	In Air.	In Oil or Compound.
	mm.	mm.	mm.	mm.
660	16	—	19	—
2200	38	—	38	—
3300	51	13	51	19
6600	64	19	89	25

IMPORTANT NOTE :—The above figures do not apply to creepage distance along the surface of insulators or of insulating bases.

6. **Mechanical Strength.**—The bus-bars and connections are to be so proportioned and supported as to be capable of safely withstanding the maximum mechanical stresses to which they may be subjected by the initial value of the short circuit current.

APPENDIX 2.

MOTORS AND GENERATORS FOR AUXILIARY PURPOSES.

1. **Classes of Rating.**—(*a*) CONTINUOUS RATING. The rating which can be carried on test for an unlimited period without exceeding the limits of temperature rise as given in **clause 3.**

(*b*) SHORT TIME RATING. The load which can be carried on test for the time specified in the rating without exceeding the limits of temperature as given in **clause 3,** starting with the machine cold. Two standard ratings are recognised, viz.:—One-hour rating and one half-hour rating.

2. **Insulating Materials.**—The following International Electrotechnical Commission Classifications are adopted as standard.

CLASS A. Cotton, silk, paper and similar organic materials when impregnated or immersed in oil, also enamelled wire.

CLASS B. Mica and asbestos and similar inorganic materials in built up form combined with binding cement. If Class A material is used in small quantities for structural purposes only in conjunction with Class B insulation, the

combined materials may be considered as Class B, provided the electrical and mechanical properties of the insulated winding are not impaired by the application of the temperature permitted for Class B material.

3. **Limits of Temperature Rise.**—The temperature rise measured by thermometer when tested under rated conditions is not to exceed the following limits :—

Part of Machine.	Temperature Rise.	
	Machines other than Totally Enclosed.	Totally Enclosed Machines.
1. Windings insulated with Class A material and cores with which they are in contact	72° F.(40° C.)	90° F.(50° C.)
2. Commutators	81° F.(45° C.)	99° F.(55° C.)
3. Slip Rings—open type...	81° F.(45° C.)	99° F.(55° C.)
enclosed ...	99° F.(55° C.)	99° F.(55° C.)

The temperature rise of uninsulated parts including cores not in contact with insulated windings is in no case to reach such a value that there is a risk of injury to any insulating material on adjacent parts.

The standard ratings are suitable for machines working with a temperature of cooling air not exceeding 40°C. For machines in hot situations or tropical climates *see* **Section 2, clause 1** and **Section 11, clause 2** of the **Rules for Electrical Equipment.**

4. **Overloads and Excess Current and Torque.**—Motors and generators are to be capable of carrying, without injury, the following sustained overloads after having attained the temperature rise corresponding to their rated load, the voltage and frequency being maintained at their rated values :—

Motors with continuous rating (not totally enclosed) are to withstand the following overloads in torque :—

Sizes 10 H.P. and upwards per 1000 r.p.m. ... ... 25 per cent for 2 hours.
Sizes 4 H.P. per 1000 r.p.m. up to 10 H.P. per 1000 r.p.m. ... ... 25 per cent for half-hour.
Sizes below 4 H.P. per 1000 r.p.m. ... ... 25 per cent for 15 minutes.
All sizes (including totally enclosed ... ... 50 per cent for 1 minute.
D.C. motors up to 150 H.P. per 1000 r.p.m. ...100 per cent for 15 seconds.
A.C. motors of all sizes ...100 per cent for 15 seconds.

Motors with Short Time Rating including totally enclosed motors :—

All sizes ... ...100 per cent for 30 seconds.

Machines with short time ratings and all totally enclosed machines are not required to carry sustained overloads.

Generators with continuous rating (not totally enclosed) are to carry the following overloads in current at full-rated volts :—

Sizes 7½ k.v.a. and upwards per 1000 r.p.m. ... 25 per cent for 2 hours.
Sizes 3 k.v.a. to 7½ k.v.a. per 1000 r.p.m. ... 25 per cent for half-hour.
Sizes below 3 k.v.a. per 1000 r.p.m. ... ... 25 per cent for 15 minutes.
All sizes, including totally enclosed generators, 50 per cent for one minute.

Note.—k.v.a.=k.w. for direct current machines.

5. **Commutation.**—A D.C. machine is to work with fixed brush setting from no load to the momentary excess current or torque specified, and is to work sparklessly and without injury to the surface of the commutator or brushes from no load to the rated load, and without injurious sparking or injury to the commutator or brushes up to the momentary (one minute or less) excess current or torque specified.

The commutation test is to be applied at the conclusion of the temperature test.

6. **High Voltage (Dielectric) Tests.**—The high voltage test is to be applied only to new and completed machines in normal working condition with all its parts in place, at the makers' works, preferably at the conclusion of the temperature test. It will be applied between the windings and the frame with the core connected to the frame, and to any windings not under test.

The full test voltage is to be maintained for one minute, and is to be made with alternating voltage of any convenient frequency between 25 and 100 cycles per second.

Machine or Part.	Test Voltage.
1. Machines under 3 B.H.P., k.w., or k.v.a.	1000 v. + twice the rated voltage.
2. Machines 3 B.H.P., k.w., or k.v.a. and over.	1000 v. + twice the rated voltage, with a minimum of 2000 v.
3. Field windings of synchronous generators.	10 times the excitation voltage : Minimum...2000 v. Maximum...3500 v.
4. Exciter	Not less than that applied to the field windings of the machine to which it is connected.
5. Induction motor rotor windings not permanently short circuited.	For non-reversing motors 1000 v. + twice the maximum voltage which could be induced between the slip rings.

7. **Insulation Resistance.**—The insulation resistance in megohms when the high voltage test is applied is to be not less than

$$\frac{\text{rated volts}}{1000 + \text{rated output in k.v.a. or B.H.P.}}$$

The insulation resistance is to be measured with a D.C. voltage of about 500.

8. **Performance Tests.**—Tests are to be carried out at the makers' works to ensure that the machine complies with the requirements in respect to limits of temperature rise, excess current and torque, commutation and high voltage tests.

In the case of generators up to 50 k.v.a. per 1000 r.p.m. type tests of temperature rise, excess current and torque, and commutation taken on a machine identical in rating and all other essential details may be accepted, in conjunction with abbreviated tests on each individual machine.

For the abbreviated test each machine is to be run and is to be found electrically and mechanically sound and in working order in all particulars, and is to have a high voltage (dielectric) test.

The temperature test may be carried out at any convenient air temperature, and no correction should be made in the observed temperature rise in those cases where the temperature of the cooling air during the test is different from that expected in service. The temperature test for continuous rated machines is to continue until there is sufficient evidence that the temperature rise would not exceed the specified limits if the tests were prolonged.

9. **Temperature Measurements.**—The temperatures are to be measured by thermometers applied to the hottest accessible surfaces during the test period, and other thermometers to the accessible surfaces of the rotating parts as soon as the machine is stopped after the test. The bulb of the thermometer, except at the point of contact, is to be covered with a pad of felt, cotton-wool or other non-conducting material, 3 mm. thick, extending at least 20 mm. in every other direction from the bulb, and pressed into contact to prevent loss of heat by radiation and convection from the bulb.

The temperature of the cooling air is to be the mean of several thermometers at different points around and half-way up the machine, and at distances of one to two metres away from it.

APPENDIX 3.

ALTERNATORS, MOTORS AND DIRECT CURRENT GENERATORS FOR ELECTRIC PROPULSION PURPOSES.

1. **Rating.**—The continuous maximum rating is the load which can be carried on test for an unlimited period without exceeding the specified limits of temperature rise.

2. **Insulating Materials.**—The following International Electrotechnical Commission Classifications are adopted as standard.

CLASS A. Cotton, silk, paper and similar organic materials when impregnated or immersed in oil, also enamelled wire.

CLASS B. Mica and asbestos and similar inorganic matererials in built-up form combined with binding cement. If Class A material is used in small quantities for structural purposes only in conjunction with Class B insulation, the combined materials may be considered as Class B, provided the electrical and mechanical properties of the insulated winding are not impaired by the application of the temperature permitted for Class B material.

3. **Limits of Temperature Rise.**—(*a*) METHODS OF MEASUREMENT. The method to be used in any particular case is stated in **clauses** (*b*), (*c*) and (*d*) below.

(*b*) EMBEDDED TEMPERATURE DETECTORS. (E.T.D.) This is to be employed for the slot portion of the stator windings of alternators having a rated output of 5000 k.v.a. or over, alternating current motors of 5000 S.H.P. or over, or machines of either type having an axial core length of one metre or over.

(*c*) THERMOMETERS. This method is applicable to alternating current windings, where neither the E.T.D. method nor the resistance method is applicable, and to series windings of low resistence, exciter windings and miscellaneous parts. Mercury or alcohol bulb thermometers are to be employed, the latter being used where the magnetic field alternates or rotates.

The temperatures are to be measured by thermometers applied to the hottest accessible surfaces during the test period and other thermometers to the accessible surfaces of the rotating parts as soon as the machine is stopped after the test. The bulb of the thermometer, except at the point of contact, is to be covered with a pad of felt, cotton-wool or other non-conducting material 3 mm. thick, extending at least 20 mm. in every other direction from the bulb and pressed into contact to prevent loss of heat by radiation and convection from the bulb.

(*d*) RESISTANCE METHOD. The measurement of rise of temperature by increase of resistance method is applicable to all field windings (except stationary low resistance field windings and exciter field windings) and to stator windings not requiring the use of E.T.Ds. It is not to be used for alternating current windings of machines requiring more than five minutes to come to rest.

Resistance measurements are to be made before and during the temperature test.

(*e*) Limits of Temperature Rise Permissible. The temperature rise of any main propelling machine is not to exceed the limits given in **Table I.** of this appendix when tested at the continuous maximum rating for a duration sufficient to show that the temperature rise would not exceed the specified limits if the test were prolonged. When a machine has more than one rating, the test is to be carried out at the rating which produces the greatest temperature rise. In cases where this cannot be determined beforehand, the machine is to be tested separately under each of its ratings.

(*f*) Temperature of Cooling Air. The temperature of cooling air for open type machines is to be the mean of several thermometers at different points around and half-way up the machine and at distances of one to two metres away from it.

Table I.

LIMITS OF PERMISSIBLE TEMPERATURE RISE.

Item.	Part of Machine.	Class A Material.		Class B Material.			
		By Thermometer method. 1	By Resistance method. 2	By Thermometer method. 3	By Resistance method. 4	By E.T.D. (*a*) (see below.) 5	By E.T.D. (*b*) (note below.) 6
1.	A.C. windings of stators or rotors.	81°F. (45°C.)	90°F. (50°C.)	99°F. (55°C.)	126°F. (70°C.)	126°F. (70°C)	108°F. (60°C)
2.	Field windings (other than 3, 4 & 5).	*	90°F. (50°C.)	*	126°F. (70°C.)	*	*
3.	Exciter windings	81°F. (45°C.)	*	99°F. (55°C.)	*	*	*
4.	Low resistance field windings of more than one layer, or compensating windings.	90°F. (50°C.)	*	108°F. (60°C.)	*	*	*
5.	Single layer field windings with exposed surface.	99°F. (55°C.)	99°F. (55°C.)	135°F. (75°C.)	135°F. (75°C.)	*	*
6.	Rotating field windings of turbine driven alternators.	*	90°F. (50°C.)	*	144°F. (80°C.)	*	*
7.	Short circuit windings insulated.	99°F. (55°C.)	*	135°F. (75°C.)	*	*	*
8.	Windings of armatures having commutators.	81°F. (45°C.)	*	99°F. (55°C.)	*	*	*
9.	Short circuited windings un-insulated.	The temperature rise of these parts is in no case to reach such a value that there is a risk of injury to any insulating or other material on adjacent parts.					
10.	Iron core and other parts not in contact with windings.						
11.	Iron core and other parts in contact with windings	The same limits of temperature rise as permitted for adjacent parts as given in Cols.1 and 3 (or 2 and 4 in the case of item 2).					
12.	Commutators	81°F (45°C.).					
	Slip rings (open)	81°F. (45°C.).					
	Slip rings (enclosed) ...	90°F. (50°C.).					

(*a*) Between coils in one slot.
(*b*) Between outside of coil and bottom of slot.
* This method of measurement is not recognised in these cases.

4. **Excess Current and Torque.**—(*a*) Generators are to be capable of withstanding on test for 15 seconds a current in amperes 50 per cent in excess of their rated current, the voltage being maintained as near the rated output as possible consistent with the maximum capacity of the prime mover. The exact value of the voltage is not important.

(*b*) Direct current motors are to be capable of withstanding on test for 15 seconds a torque 50 per cent in excess of that corresponding to their rating, the voltage being maintained at rated value.

(*c*) Synchronous motors are to be capable of withstanding for 15 seconds without dropping out of synchronism a torque 50 per cent. in excess of the torque corresponding to their rating, the voltage and frequency of the A.C. system with which they are synchronised being maintained at their rated values and the excitation of the motor being maintained at the value required to meet the specified conditions at rated load.

(*d*) Induction motors are to be capable of withstanding for 15 seconds without stalling a torque 50 per cent in excess of the torque corresponding to their rating, the voltage and frequency being maintained at their rated values.

5. **Commutation.**—Direct current machines are to work with fixed brush setting from no load to the excess current or torque specified and are to work practically sparklessly and without injury to the surface of the commutator or brushes from no load to the rated load and without injurious sparking or injury to the commutator or brushes up to the excess current or torque specified.

The commutation test is to be applied at the conclusion of the temperature test.

6. **High Voltage Tests.**—(*a*) The high voltage tests in accordance with **Table II** of this appendix are to be applied only to new and completed machines in normal working condition with all its parts in place and, unless otherwise agreed, are to be carried out at the makers' works, preferably at the conclusion of the temperature test.

(*b*) A high voltage test in accordance with **Table II** is to be applied between the windings and the frame of the machine with the core connected to the frame and to any windings not under test.

The test voltage is to be based on the rated voltage.

In special cases of machines such as series connected machines, the test voltage is to be based on the rated voltage or the highest R.M.S. voltage reached between any part of the winding and the frame or between any two parts of the winding (whichever is the greatest).

(*c*) When for any reason it is considered necessary to make additional high voltage tests on a machine which has already passed its tests in accordance with **clause** (*b*) and is installed in the ship, the test voltage is to be 75 per cent of the value specified in **Table II.** Before the high voltage test is applied the windings are to be cleaned and the insulation resistance measured. The machine is to be thoroughly dried

out before the application of the high voltage test if the insulation resistance in megohms is less than

$$\frac{\text{rated voltage}}{1000 + \text{rated k.v.a.}}$$

(*d*) METHOD MAKING HIGH VOLTAGE TEST. The test is to be made with alternating voltage of approximately sine wave form of any convenient frequency between 25 and 100 periods per second. The R.M.S. value of the applied voltage is to be measured by a suitable voltmeter connected to the output side of the testing transformer, by means of a voltmeter used with a suitable calibrated potential transformer or by means of a voltmeter used in conjunction with a special calibrated voltmeter winding on the testing transformer.

(*e*) DURATION OF HIGH VOLTAGE TEST. The test is to be commenced at a voltage of about one-third the test voltage and increased to the test voltage as rapidly as is consistent with its value being indicated by the voltmeter. The full test voltage is then to be maintained for one minute, after which the test voltage is to be rapidly diminished to one-third its full value before switching off.

TABLE II

ITEM.	HIGH VOLTAGE (DIELECTRIC) TESTS.	
	Machine or Parts.	Test Voltage (R.M.S.)
1.	Machines in general ...	1000 v. + twice the rated voltage (with a minimum of 2000 volts).
2.	Field windings for synchronous generators when the excitation voltage does not exceed 750 v.	10 times the excitation voltage : Minimum ...2000 v. Maximum...3500 v.
3.	Field windings for synchronous motors started with the A.C. windings active :—	
	(*a*) when intended to be started up with the field windings short-circuited.	10 times the excitation voltage : Minimum ...2000 v. Maximum...3500 v.
	(*b*) when intended to be started up with the field windings separated by a field dividing switch.	5000 v.
	(*c*) when intended to be started up with the fields on open circuited and without a field dividing switch.	5000 v. when the excitation voltage is less than 275 v. 8000 v. when the excitation voltage is equal to or exceeds 275 v.
4.	Exciter	Not less than that applied to the field windings of the machine to which it is connected, except when used with a synchronous machine intended to be started up from the alternating current side, in which case the test will be as given in Item 3(*a*) above.
5.	Secondary (rotor) windings of reversing induction motors not permanently short-circuited.	1000 v. + four times the voltage between the slip rings at standstill on open circuit with full primary voltage applied to stator windings.

APPENDIX 4.

ELECTRIC GENERATORS AND MOTORS, INCLUDING EXCITERS, BALANCERS, BOOSTERS, AND THE MOTORS FOR DRIVING THEM, IN CONJUNCTION WITH ELECTRIC PROPELLING MACHINERY.

1. **Rating.**—The continuous rating is the load which can be carried on test for an unlimited period without exceeding the limits of temperature rise given in **clause 3.**

2. **Insulating Materials.**—Classes A and B materials are as defined in Appendix 2.

3. **Limits of Temperature Rise.**—The temperature rise measured by thermometer when tested under rated conditions is not to exceed the following limits, except that in tropical climates or where fixed in hot situations the temperature rise of the windings is not to exceed the limits specified in the **Rules for Electrical Equipment, Section 2, clause 1** and **Section 11, clauses 2** and **6** (*g*) and the **Rules for Electric Propelling Machinery, Section 6, clause 6** (*a*).

ITEM.	PART OF MACHINE.	CLASS A MATERIAL.		CLASS B MATERIAL.	
		By Thermometer method. 1.	By Resistance method. 2.	By Thermometer method. 3.	By Resistance method. 4.
1.	A.C. windings of stators or rotors.	72°F. (40°C.)	81°F. (45°C.)	90°F. (50°C.)	117°F. (65°C.)
2.	Field windings, stationary or rotating.	*	90°F. (50°C.)	*	108°F. (60°C.)
3.	Exciter field windings ...	72°F. (40°C.)	*	90°F. (50°C.)	*
4.	Low resistance field windings of more than one layer or compensating windings.	81°F. (45°C.)	*	99°F. (55°C.)	*
5.	Single layer field windings with exposed surface.	90°F. (50°C.)	117°F. (65°C.)	117°F. (65°C.)	117°F. (65°C.)
6.	Short-circuited windings, insulated.	90°F. (50°C.)	*	117°F. (65°C.)	*
7.	Windings of armatures having commutators.	72°F. (40°C.)	*	90°F. (50°C.)	*
8.	Commutators	81°F. (45°C.)		81°F. (45°C.)	
	Slip rings (open)	81°F. (45°C.)		81°F. (45°C.)	
	Slip rings (enclosed)	99°F. (55°C.)		99°F. (55°C.)	
9.	Short-circuited windings, un-insulated.	The temperature rise of these parts is in no case to reach such a value that there is risk of injury to any insulating or other material on adjacent parts.			
10.	Iron core and other parts not in contact with windings.				
11.	Iron core and other parts in contact with windings.	Same limits of temperature rise as permitted for adjacent parts as given in Cols. 1 and 3 (or Cols. 2 and 4) in case of item 2.			

* This method of measurement is not recognised in these cases.

These temperature rises are suitable for machines working with a temperature of cooling air not exceeding 40°C.

The method of measurement applicable in any particular case is as specified in Appendix 3, **clause 3** (*c*) and (*d*).

4. **Overloads and Excess Current and Torque.**—Motors and generators are to be capable of carrying, without injury, the following sustained and momentary overloads after having attained the temperature rise corresponding to their rated load, the voltage being maintained at rated value and in the case of A.C. motors at rated frequency also.

MOTORS are to withstand the following overloads in torque :—

All sizes (including totally enclosed) { 25 per cent for two hours. 50 per cent for one minute.

GENERATORS, BALANCERS AND BOOSTERS are to withstand the following excess currents :—

95 per cent overload in current at full rated volts for two hours.

50 per cent overload in current for one minute, the voltage being maintained as near the rated value as possible, consistent with the maximum capacity of the prime mover. The exact value of the voltage is not important.

5. **Commutation.**—A D.C. machine is to work with fixed brush setting from no load to the momentary excess current or torque specified and is to work sparklessly and without injury to the surface of the commutator or brushes from no load to the rated load and without injurious sparking or injury to the commutator or brushes up to the momentary (one minute or less) excess current or torque specified.

The commutation test is to be applied at the conclusion of the temperature test.

6. **High Voltage (Dielectric) Tests.**—The high voltage test is to be applied only to new and completed machines in normal working condition with all its parts in place, at the makers' works, preferably at the conclusion of the temperature test. It will be applied between the windings and the frame with the core connected to the frame and to any windings not under test.

The full test voltage is to be maintained for one minute and is to be made with alternating voltage of any convenient frequency between 25 and 100 cycles per second.

MACHINE OR PART.	TEST VOLTAGE.
1. Machines in general ...	1000 v. + twice the rated voltage (with a minimum of 2000 v.)
2. Field windings of synchronous generators when the excitation voltage does not exceed 750 v.	10 times the excitation voltage : Minimum...2000 v. Maximum...3500 v.
3. Exciter, booster or balancer used for excitation purposes.	Not less than that applied to the field windings of the machine to which it is connected, except when used with a synchronous machine intended to be started up from the alternating current side, in which case the test will be as given in Item 2 above.
4. Induction motor rotor windings not permanently short-circuited.	For non-reversing motors 1000 v. + twice the maximum voltage which could be induced between the slip rings.

7. **Insulation Resistance.**—The insulation resistance in megohms when the high voltage test is applied is to be not less than

$$\frac{\text{rated volts}}{\text{1000 v. + rated output in k.v.a. or B.H.P.}}$$

The insulation resistance is to be measured with a D.C. voltage of about 500.

8. **Performance Tests.**—Tests are to be carried out at the makers' works to ensure that the machine complies with the requirements in respect of limits of temperature rise, excess current and torque, commutation and high voltage tests.

The temperature test may be carried out at any convenient air temperature and no connection should be made in the observed temperature rise in those cases where the temperature of the cooling air during the test is different from that expected in service. The temperature test for continuous rated machines is to continue until there is sufficient evidence that the temperature rise would not exceed the specified limits if the tests were prolonged.

The temperature of cooling air is to be ascertained as prescribed in Appendix 3, **clause 3** (*f*).

By order of the Committee,

ANDREW SCOTT,

Secretary.

71, FENCHURCH STREET, LONDON, E.C.3.

21*st June*, 1934.

Appendix 4

RULES FOR REFRIGERATING MACHINERY AND APPLIANCES.

GENERAL.

Section 1. 1. On the application of the owners of vessels fitted, or to be fitted, for carrying refrigerated cargoes, the Committee will authorise their Surveyors to survey the refrigerating machinery and appliances, and in those cases where the following conditions are complied with and a satisfactory report is received from the Surveyor, certificates of these surveys will be issued and the notation of Lloyd's R.M.C. (*in red*) (*i.e.* Lloyd's Refrigerating Machinery Certificate) will be made against the vessel's name in the Society's Register Book. In cases in which the refrigerating machinery and appliances are constructed under the special survey of the Society's Surveyors, and to their entire satisfaction, the notation ✠ Lloyd's R.M.C. (*in red*) will be made in the Register Book. The number of refrigerating units, number of compressors, the system of refrigeration, the name of the maker and date of construction of the machines, the method employed for cooling the chambers and the nature of the insulation, the refrigeration or ice melting capacity in tons per 24 hours, and the number and total capacity of the insulated cargo chambers in cubic feet, will be recorded in the special list in the Register Book.

NOTE :—A refrigerating unit comprises a prime mover, one or more compressors, one condenser and one evaporator or cooler, where these are employed.

If the prime mover is a steam engine and each cylinder drives a corresponding compressor, or if there is more than one motor similarly arranged and each compressor is connected to its own condenser and evaporator or cooler (not necessarily in separate casings) these machines are to be described as two or more units, as the case may be, provided each unit can be used either in combination or separately.

If a machine has more than one compressor, but is driven by a single prime mover and has only one condenser and one evaporator or cooler, it is to be described as one unit with one or more compressors.

In the case of compound compressors the high and low pressure cylinders are to be considered as a single compressor.

NOTE :—The refrigeration or ice-melting capacity of the machines in tons per 24 hours should be calculated at the rate of 80,155 calories, or 318,080 British Thermal Units, per English ton (*i.e.* 2,240 pounds) with temperature of evaporation = 15° C., and temperature of liquid refrigerant in the condenser = 30° C.

2. **Submission of Plans.**—In cases where the refrigerating machinery and appliances are to be constructed under special survey, plans and specifications are to be submitted for consideration.

REFRIGERATING MACHINERY.

Section 2. 1. **Power of Machinery.**—(*a*) The refrigerating machinery is to be of approved construction and of sufficient power to deal adequately with the cargo as received on board.

(*b*) Not less than two complete units of refrigerating machinery are to be fitted.

(*c*) When two units are fitted their working parts are to be interchangeable. Each unit is to be capable of maintaining the required temperatures in the cargo chambers when working 24 hours a day in the tropics.

(*d*) When more than two units are fitted, the power provided is to be such that the required temperatures can be maintained in the cargo chambers when working 24 hours a day in the tropics with any one unit out of action.

(*e*) In addition to the brine pumps and the gas condenser water circulating pump required for the maximum duty, a standby brine pump and water circulating pump are to be fitted, ready for use. The additional water circulating pump may be one of the pumps used for other purposes provided it is of adequate capacity and its use on the gas condenser does not interfere with other essential services. The circulating water is to be taken from two sea connections one of which may be the water ballast inlet.

(*f*) In any case where the total power is not available for all the insulated cargo chambers, the machinery serving each group of chambers is to comply with the foregoing requirements and the requirements for spare gear.

(*g*) Where the machinery is steam driven, the exhaust steam is to be led to the main and auxiliary condensers.

2. **Motive Power.**—The motive power is to be taken from at least two sources, each capable of the maximum duty without interference with other essential services.

3. **Special Cases.**—The Committee will be prepared to give consideration to cases of vessels engaged on voyages of short duration or to other special circumstances.

4. **Hydraulic and other Tests.**—In the case of new refrigerating machinery and appliances, the tests required are :—

(*a*) CO_2 compressors, intermediate liquid coolers, separators, condenser and evaporator coils, headers and connections to be tested by hydraulic pressure to 210 kg. per cm^2., and afterwards by air pressure to 105 kg. per cm^2. whilst submerged in water at a temperature of 32° C.

(*b*) NH_3 compressors and cast iron or steel connections to be tested by hydraulic pressure to 42 kg. per cm^2.

(*c*) NH_3 condenser, evaporator and air cooler coils to be tested by hydraulic pressure to 105 kg. per cm^2., and afterwards by air pressure to 35 kg. per cm^2., whilst submerged in water at 32° C.

NH_3 condensers or evaporators of the multitubular or shell and tube types are to be tested by hydraulic pressure to 35 kg. per cm^2., and afterwards by air pressure to 17,5 kg. per cm^2., whilst submerged in water at 32° C.

Where it is inconvenient to test the larger sizes by submersion in water the shells may be charged with air and NH_3 and tested by means of litmus paper or sulphur sticks.

(*d*) NH_3 condenser, evaporator and air cooler coils to be tested after erection in place by air pressure to 14 kg. per cm^2.

(*e*) Brine piping after erection in place to be tested by hydraulic pressure to double the working pressure at the brine circulating pumps, but in any case not less than 3,5 kg. per cm^2.

(*f*) Gas evaporator casings of cast iron and gas condenser casings, whether of cast iron or steel, to be tested by hydraulic pressure to 1 kg. per cm^2., or to double the working pressure, whichever is the greater.

(*g*) Gas evaporator, wrought iron and steel casings, to be tested by hydraulic pressure to 2 kg., if gravitation type, or to 3,5 kg. per cm^2., if pressure type, or to double the working pressure, whichever is the greater.

(*h*) Important steel castings and steel forgings are to comply with the requirements of **Sections 9** and **10**, respectively, of the **Rules for the Quality and Testing of Materials.**

5. **Safety Valves.**—(*a*) Suitable spring-loaded safety valves are to be provided on condenser casings and evaporator casings of pressure type.

(*b*) A relief valve or safety disc is to be fitted on or near each compressor.

6. **Oil Separator.**—A suitable oil separator with drain to be fitted to the gas line near the compressor.

7. **Oil Engines.**—Where refrigerating machinery is driven direct by oil engines, the sizes of the crankshafts and particulars of the engines and of the proposed spare gear in connection therewith are to be submitted for consideration.

8. **Cooling Tests.**—Upon completion of the installation under special survey the refrigerating machinery is to be tested under working conditions and the insulated chambers are to be cooled down simultaneously to about −12° C. where they are intended for carrying frozen and chilled meat cargoes, and to about −7° C. where they are intended for carrying fruit and similar produce which require only moderate temperatures. The rise of temperature in the refrigerated chambers is to be noted upon the expiration of about 12 hours' time after the machinery and cooling appliances have been shut off.

INSULATION AND FITTINGS.

Section 3. 1. **Insulation.**—The insulation is to be sound and in good order and of efficient construction. The details of construction showing the amount and nature of the insulating material employed in the various parts are to be reported to the Committee.

2. **Protection of Insulation.**—The insulation of the lower hold chamber floor and the tunnel top in way of the hatchways and about 0,60 m. beyond are to be protected with hardwood sheathing about 50 mm. thick or similar protection.

3. **Access Plugs.**—Insulated removable portions are to be arranged in the insulation, where required, to provide easy access to the bilges and bilge suction roses. Similar provision to be made for access to the tank air and sounding pipes and also for examination of the heels of the pillars.

4. **Oil Storage Tank Tops and Bulkheads.**—The insulation of all oil storage tank tops to have an air space of 50 mm. provided between the under side of the insulation and the tank top plating and the supporting battens to be arranged athwartship to permit of free drainage to the bilges. As an alternative to the air space, approved inodorous material not less than half inch in thickness may be laid on the tank top plating.

The insulation of bulkheads in way of oil storage tanks is to be provided with an air space of not less than 50 mm. between the insulation and the bulkhead plating to permit of free drainage from the latter into the oil gutterways, and thence to the bilges. Provision to be made for ventilating the air space, the vents being led to the open air and their outlets being fitted with a wire gauze diaphragm, which can be easily removed for renewal.

5. **Fireproof Insulation.**—The insulation in way of coal bunkers and of any surfaces exposed to excessive heat, is to be silicate cotton, or other approved fireproof material, the wood grounds are to be fireproofed and asbestos strips are to be fitted between the wood grounds and the steel work to which they are attached.

Brine leads in bunkers may be packed with granulated cork, but there is to be a thick outer covering of silicate cotton and the whole protected by steel plates.

6. **Watertight Bulkhead Fittings.**—Where cooling pipes pass through watertight bulkheads, or deck plating, the fittings and packing of the stuffing-boxes are to be both fireproof and watertight.

7. **Cargo Battens.**—(*a*) Cargo battens are to be provided for the floor or deck and the walls of the chambers previous to loading refrigerated cargoes.

(*b*) Those for the walls of the chambers are to be fastened and should be at least 50 × 50 mm., one batten being placed over each frame or ground, the others being intermediately arranged to suit the class of cargo.

(*c*) The cargo battens for the floors or decks of the chambers are to be fitted to suit the class of cargo.

(*d*) The tunnel top insulation is to be fitted with 75 × 75 mm. battens.

8. **Thermometer Tubes.**—(*a*) The number and position of the thermometer tubes in the insulated chambers should be submitted for consideration.

(*b*) Thermometer tubes, their flanges and covers are to be insulated from the deck plating and on weather decks they are to be so arranged that water will not run down when taking the temperatures.

(*c*) The inside diameter of thermometer tubes is to be not less than 50 mm. and the tubes are to be out of contact with cold decks.

(*d*) Where the thermometer tubes and cooling pipes pass through compartments or chambers other than their respective insulated chambers they are to be efficiently insulated.

9. **Protection of Pipes.**—All pipes, including air and sounding pipes, which pass through or into insulated chambers are to be well insulated in order to prevent the formation of ice inside the pipes.

10. **Draining Arrangements.**—(*a*) Provision is to be made for draining the inside of all insulated chambers. Drains from lower holds to bilges are to be fitted with liquid sealed non-return bilge traps.

Drains from 'tween deck chambers to the hold bilges are to be fitted with liquid sealed traps.

(*b*) Where practicable, sluices, scupper or drain pipes, which may permit drainage from compartments outside the insulated chambers into the bilges of the latter, should not be fitted; but, in the event of their being fitted, means are to be provided for blanking them off when the chambers are being used for carrying refrigerated cargoes.

11. **Sounding Pipes.**—Where sounding pipes are fitted in way of insulated chambers their deck connections are to be so arranged that they will be insulated from the deck plating in order to prevent the formation of ice inside the sounding pipes.

12. **Brine Cooling Systems.**—(*a*) Where the brine system of refrigeration is employed the brine circulating pipes and tanks should not be galvanised on the inside.

(*b*) In cases where internally galvanised tanks or cooling pipes are fitted, the brine cooling and return tanks, if closed, are each to be provided with a ventilating pipe or pipes led to the open air in a situation where no danger will be incurred from the issuing gas and each ventilating pipe must be fitted with a wire gauze diaphragm which can be easily removed for renewal.

(*c*) Where the tanks are not closed, the compartments in which they are situated must be efficiently ventilated.

(*d*) The brine pipes in each refrigerated chamber are to be arranged in not less than two sections, but particulars of the number and arrangement of sections are to be submitted for cousideration. Valves or cocks are to be fitted so that any section can be shut off when necessary.

(*e*) The thickness of the brine pipes at the bottom of the screw threads should not be less than 2,5 mm.

SPARE GEAR.

Section 4. 1. The following spare gear will be required in all cases :—

Lengths and bends of piping of each size used, together with flanges, couplings and screwing apparatus.

Sundry cocks, valves, flanges and fittings.

Assorted bolts, studs and nuts.

A quantity of packings and joint rings.

One complete set of crank shaft coupling bolts.

One complete set of motor coupling bolts and washers.

One compressor piston and rod complete for each size used.

One set of compressor suction and delivery valves with rings and boxes for each size used.

One complete set of packing for the compressor piston rod for each size used.

One gas regulator valve complete.

One set of valves for water circulating, air and brine pumps for each size used.

In cases where approval is given to alternative arrangements under **Section 2, clause 3,** additional spare gear may be required according to the circumstances of the case.

2. Where steam driven air circulating fans are fitted, the following spare gear will be required :—

For each size used :—

1 crank shaft.

1 steam piston and rod complete.

1 steam cylinder cover.

1 set of connecting rod top and bottom end, and bearing bushes, and bolts complete.

3. Where the refrigerating machinery or its auxiliaries are electrically driven, the following spare gear will be required :—

(*a*) For the generators, motors, control gear and switchboard, a set of spare gear in accordance with **Section 18** of the **Rules for Electrical Equipment.**

(*b*) For electrically driven air circulating fans the following spare gear will be required :—

1 shunt field coil of each size and type used.

1 armature of each size used, complete with shaft.

4. Where the refrigerating machinery is driven direct by oil engines, the proposed spare gear for the engines is to be submitted for consideration.

PERIODICAL SURVEYS.

Section 5. 1. A complete Survey as detailed in **clause 8** is to be held every six months.

2. In the cases of vessels engaged on voyages of three months' duration, or less, a modified survey as detailed in **clause 9** is to be held in about three months' time after the date of the complete periodical survey.

3. A loading port survey, as detailed in **clause 10,** is to be held every voyage in the case of vessels engaged on voyages of more than two months' duration, but where the voyages are of shorter duration, this survey need only be held at intervals of two months.

In the case of vessels of less than 1130 cubic metres capacity engaged on voyages of only a few days' duration, the modified survey required in **clause 2** would be accepted in lieu of the above mentioned loading port survey.

4. Where any essential repairs or renewals are effected to the refrigerating machinery or insulation, these must be carried out under the inspection, and to the satisfaction, of the Society's Surveyors. Repairs and renewals effected at ports where there is no Surveyor to this Society must be surveyed by one of the Society's Surveyors at the earliest opportunity.

5. Where, in any case, only part of the requisite examination is held, the certificate will be endorsed with the statement of what is required to complete the survey.

6. The date following the record Lloyd's R.M.C. (*in red*) indicates the date of the last complete periodical survey of the refrigerating machinery and appliances, as detailed in **clause 8.**

7. Complete Periodical Survey. — The complete periodical survey required in clause 1 will consist of the following:—

(*a*) The machinery is to be examined under working conditions, and, according to the system of refrigeration employed, the following data are to be noted:—

The temperature of the delivery and return air at the direct expansion or brine cooled batteries, or of the outflow and return cooling brine; the temperatures of the refrigerated chambers, atmosphere, cooling water inlet and discharge, and of the gas in the condensers and evaporators, also the density of the brine. It is recommended that the examination of the machinery under working conditions should be made upon the vessel's arrival at the port of discharge, before the cargo is fully discharged.

(*b*) The steam pipes, water pipes and connections, the crank shaft and bearings, the connecting rods, the engine cylinders and their pistons and valves, the compressors and pistons and their piston rods, gland and neck bushes and valves, the steam condenser water and steam sides, the gas condenser coils and the evaporator coils or direct expansion battery piping and the water and brine sides of their respective shells or tanks as far as practicable, the working parts of the water and brine circulating pumps, of the air and feed pumps and of the fan engines are to be examined.

Starting and injection air receivers in connection with oil engines are to be examined at the Special Surveys Nos. 1, 2 and 3 and their pipes and fittings are to be cleaned and examined annually.

(*c*) The refrigerating liquid pipes, separators and receivers, and the gas return pipes are to be examined externally as far as practicable.

(*d*) Where wrought iron or steel piping is employed for the gas condenser coils, these coils are to be drawn for examination and tested to 70 kg. per cm^2. hydraulic pressure for NH_3 and 175 kg. per cm^2. hydraulic pressure for CO_2, at intervals of four years.

Where copper piping is employed for the gas condenser coils, these coils are to be tested in place after six years to 175 kg. per cm^2. hydraulic pressure, and at the twelfth year, and each succeeding six years, they are to be drawn for examination and tested to 175 kg. per cm^2. hydraulic pressure.

(*e*) Where the refrigerating machinery or its auxiliaries are electrically driven, a general examination of all the generators, motors and their control gear, and cables, is to be made, and the insulation resistance measured on the occasion of each Periodical Survey. The insulation resistance is to be not less than 100,000 ohms, and for the purpose of this test each item may be taken separately.

One of the engines or turbines driving the generators, together with the generator and one of the compressor motors, is to be opened up and examined completely every 12 months in regular rotation.

(*f*) Where auxiliary machinery is fitted, the working parts of the same are to be examined.

(*g*) The spare gear is to be examined.

(*h*) Special attention is to be given to the condition of the compressors, including their pistons and valves, rods, and gland and neck bushes.

(*i*) The brine pipes and brine return tanks, and the direct expansion cooling pipes and their connections, where fitted, are to be carefully examined as far as practicable.

Every four years sufficient insulation is to be stripped from groups of brine pipe leads in bunkers or near boilers to permit of the condition of the pipes being ascertained.

(*j*) Where the brine may escape to the bilges, the cement in way of the latter is to be examined.

(*k*) The insulation throughout the cargo chambers is to be carefully examined. Where charcoal, silicate cotton, granulated cork or similar media are employed for insulating purposes, the insulation is to be carefully examined for fullness and dryness by boring where necessary. The test holes are to be efficiently closed. Special attention is to be paid to the insulation under trunks and hatches where dampness may accumulate, to the sides under stringers and under decks, and to the tunnel tops. All bilge hatches are to be removed, the bilges cleared and the suction pipes, suction roses and sounding pipes are to be examined. Hatches, air trunkways and thermometer tubes, with their connections and fastenings, are to be examined, and where trunkways pass through watertight bulkheads, the watertight doors are to be examined and worked.

(*l*) The air trunkways are to be made as airtight as practicable, and their fastenings secure.

(*m*) Where brine pipes are fitted, these should be examined under frosted conditions where practicable.

(*n*) Where direct expansion pipes are fitted, these are to be examined whilst under the full working conditions.

(*o*) Sea injection valves are to be opened and examined whenever the vessel is in dry dock.

8. **Modified Survey.**—The modified survey required in **clause 2** will consist of the following :—

(*a*) Provided the machinery when tested under working conditions is found to be satisfactory, the following parts only will be required to be examined, viz. :—

Air and other compressors and their valves.

Expansion cylinders and valves in dry air machines.

The spare gear.

(*b*) The insulation to be examined generally, and tested if necessary.

(*c*) The air trunkways to be examined.

(*d*) Where brine pipes are fitted, these should be examined under frosted conditions where practicable.

(*e*) Where direct expansion pipes are fitted, these are to be examined whilst under the full working conditions.

9. **Loading Port Survey.**—(*a*) If the machinery and insulation have been surveyed and passed at a home port, the further survey required at a loading port will consist of an inspection to ascertain that the chambers are clean, that the brine pipes are free from leakage, that the cargo battens are in good order and that no damage has been sustained to the insulation prior to the loading of the refrigerated cargo, and also of a test of the refrigerating machinery under working conditions, the temperatures in the chambers being noted.

(*b*) If the vessel loads at more than one port, one survey only at a loading port will be required, provided it includes the examination of all insulated chambers.

(*c*) If there is not a Surveyor to the Society available at the loading ports, or if there is not one obtainable from a port within a reasonable distance, this survey may be held at a port where the outward cargo is discharged ; or the Committee will accept the report of a survey held at the loading port by a Surveyor appointed by Lloyd's Agent ; or (in any case where there is no Lloyd's Agent) the report of a survey held by a reliable Surveyor, if available ; or (if no such Surveyor is available) a report signed by two competent Engineers of the vessel.

By order of the Committee,

MALCOLM K. SCOTT,

Secretary.

71, Fenchurch Street, London, E.C.3.

29*th October*, 1936.

RULES FOR QUALITY AND TESTING OF MATERIALS.

QUALITY AND TESTING OF SHIP STEEL AND BOILER MATERIAL.

Steel Plates, Bars and Angles.

Section 1. 1. **General Regulations.**—The steel used in the construction of vessels or boilers intended for vessels classed, or proposed for classification, in the Society's Register Book, is to comply with the tests described hereafter.

2. **Process of Manufacture.**—The steel is to be made by the Open Hearth process, Acid or Basic.

3. **Freedom from Defects.**—The finished material is to be free from cracks, surface flaws, and lamination. It is also to have a workmanlike finish, and must not have been hammer-dressed.

4. **Testing and Inspection.**—(*a*) The prescribed tests and inspections are to be made at the place of manufacture prior to despatch ; but, in the event of any of the material proving unsatisfactory in the course of being worked into vessels or into boilers, such material shall be rejected, notwithstanding any previous certificate of satisfactory testing, and such further tests of the material from the same charge may be made as the Surveyor may consider desirable.

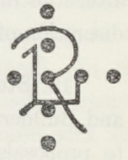
(*b*) All test pieces are to be selected by the Surveyor and tested in his presence, and he is to satisfy himself that the prescribed conditions are fulfilled.

5. **Additional Tests before Rejection.**—(*a*) Where any of the test pieces first selected by the Surveyor do not fulfil the test requirements, two further tests of the same kind may be made from the same plate or bar, but where either of these fail, the plate or bar from which the test pieces were cut is to be rejected. In all such cases further tests are to be made before any material from the same charge can be accepted.

(*b*) Where a tensile test piece breaks outside the middle half of its gauge length, and the elongation is less than that required by the Rules, the test may, at the Maker's option, be discarded and another test be made of the same plate or bar.

6. **Branding.**—(*a*) Every plate and bar is to be clearly and distinctly marked by the Maker in two places with the Society's brand, thus :—  indicating that the material has complied with the Society's tests.

(*b*) Plates or bars bearing this brand are not to be forwarded from the Steel Works until the prescribed tests have been made by the Surveyor, and the mill sheets have been signed by him. All plates and bars are also to be legibly stamped in two places with the Maker's name or trade mark, and the place where made. They are also to be stamped with numbers or identification marks by which they can be traced to the charge from which the material was made.

7. **Defacing of Rejected Material.**—In the event of the material failing, in any case, to withstand the prescribed tests, the Surveyor is to see that the Society's brand stamped on the plates and bars by the Maker has been defaced by punch marks extending beyond the brand in the form of a cross, thus :—  denoting that the material has been rejected.

8. **Maker's Certificate.**—Before the mill sheets are signed by the Surveyor, the Maker is required to furnish him with a certificate guaranteeing that the material has been made by the Open Hearth process, and that it has been subjected to, and has withstood satisfactorily, the required tests in the presence of the Surveyor. The following form of certificate will be accepted if printed on each mill sheet with the name of the firm, and initialled by the Test House Manager :—

> "We hereby certify that the material described below has been made by the Open Hearth process, and is that which has been satisfactorily tested in the presence of the Surveyor in accordance with the Rules of Lloyd's Register."

9. **Facilities for Inspection.**—The Maker is to adopt a system of marking the ingots, billets, slabs, plates, bars, and other material which will enable all finished material to be traced to the original charge, and the Surveyor must be

given every facility for tracing all plates and bars to their respective charges, and for witnessing the required tests. When the Surveyor is satisfied with the material and with the results of the tests, he is to be furnished with two copies of the advice notes of the material for his signature, one of which is to be forwarded by the Manufacturer to the Shipbuilder or Boiler Maker, and the other is to be forwarded by the Surveyor to the Surveyors at the port where the vessel or boiler is to be built.

10. Steel not produced where Rolled.—Where steel is not produced in the works at which it is rolled, a certificate is to be supplied to the Surveyor, stating the Open Hearth process by which it was made, the name of the Steel Maker who supplied it, also the numbers of the charges for reference to the books of the Steel Maker. The number of the charge is to be marked on each ingot or billet for the purpose of identification, and the finished plates and bars are also to be legibly stamped in two places with the Maker's name or trade mark, and the place where made. They are also to be stamped with numbers or identification marks by which they can be traced to the charge from which the material was made.

11. General.—In addition to the tests described hereafter the material may be subjected to further tests at the discretion of the Surveyors.

12. Steel of other Tenacity.—When desired by Owners and Builders, consideration will be given by the Committee to proposals for the use of steel of other tenacity than is provided for in the Rules.

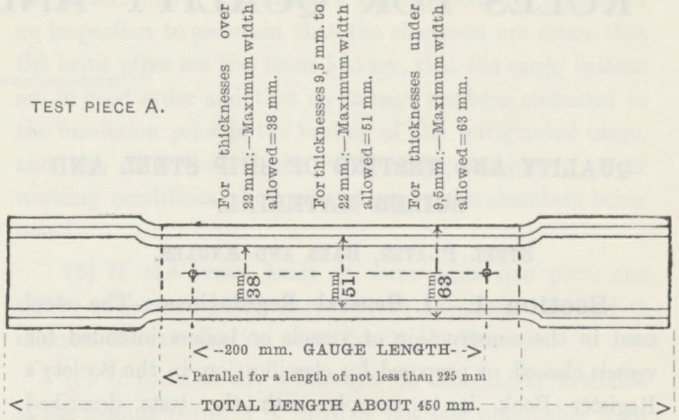
STANDARD TEST PIECES.

Section 2. **1. Tensile Test Pieces.**—The tensile strength and ductility are to be determined from Standard test pieces cut lengthwise or crosswise from the rolled material. Where material is annealed or otherwise treated before despatch, the test pieces are to be similarly and simultaneously treated with the material before testing.

2. Plates.—(*a*) Wherever practicable the rolled surfaces are to be retained on two opposite sides of the test piece. The elongation is to be measured on a Standard test piece having a gauge length of 200 mm.

(*b*) For material more than 22 mm. in thickness the width of the test piece between the gauge points is not to exceed 38 mm.; for material 22 mm. to 9,5 mm. in thickness, inclusive, the width is not to exceed 51 mm.; for material less than 9,5 mm. in thickness the width is not to be more than 63 mm. In other respects the test pieces are to conform generally to the Standard test piece A.

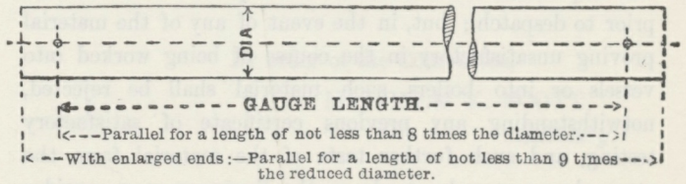
TEST PIECE A.



3. Round Bars.—(*a*) Bars may be tested full size as rolled, or they may be turned down to a convenient size, and if tested 25 mm. in diameter, or under, the test piece is to have a gauge length of 8 times the diameter. Where enlarged ends are used the length of the parallel portion is not to be less than 9 times the reduced diameter of the test piece (see Standard test piece B).

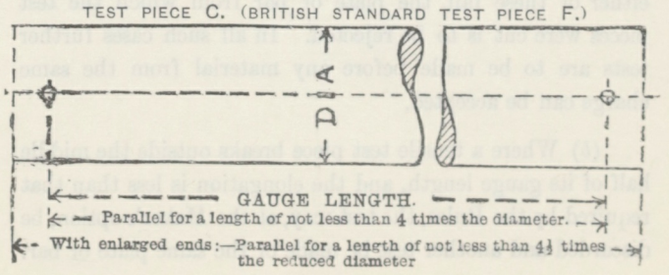
The sectional area of the test piece is not to be less than 160 mm^2.

TEST PIECE B.



(*b*) Where bars are above 25 mm. diameter, and are tested full size as rolled, or have been turned down and the resulting test piece is above 25 mm. diameter, a gauge length of 4 times the diameter may be used if preferred by the Manufacturer, in which case an increased elongation will be required, as specified in **Sections** 5 and 6. Where enlarged ends are used, the length of the parallel portion is not to be less than $4\frac{1}{2}$ times the reduced diameter (see Standard test piece C).

TEST PIECE C. (BRITISH STANDARD TEST PIECE F.)



4. **Straightening of Test Pieces.**—Any straightening of test pieces A, B and C which may be required is to be done cold.

BEND TEST PIECES AND TESTS FOR SHIP AND BOILER STEEL.

Section 3. 1. **Number of Bend Tests for Ship Steel.**—A cold or temper bend test is to be taken from each plate or bar as rolled, and these tests are to be in about equal numbers from each charge; but a cold bend test is to be taken from all plates specially marked for cold flanging.

2. **Number of Bend Tests for Boiler Steel.** (*a*) **Plates.**—A cold or temper bend test piece is to be taken from each plate as rolled. For plates exceeding 2500 kg. in weight one bend test piece is to be taken from each end.

The bend tests from shell plates, butt straps and other plates which have not to be flanged or worked in the fire or which when in use are not to be exposed to flame, are to be cold bend tests. The bend tests from plates which have to be flanged or worked in the fire or which when in use will be exposed to flame are to be temper bend tests. In the cases of shell plates permitted to have a tensile strength above 53,5 kg. per mm². one temper bend is to be made in addition to the cold bends above specified in the case of each plate which is above 53,5 kg. per mm².

(*b*) **Angle Bars.**—A cold or a temper bend test is to be taken from each angle bar rolled.

(*c*) **Stay Bars.**—A cold and a temper bend test are to be taken from every 15 stay bars as rolled from each charge.

3. **Cold and Temper Bend Test Pieces.**—(*a*) Test pieces are to be sheared lengthwise or crosswise from plates or bars, and are not to be less than 38 mm. wide, but for small bars the whole section may be used. For rivet bars bend tests are not required.

(*b*) In all cold bend tests, and in temper bend tests on test pieces 13 mm. in thickness and above, the rough edge or arris caused by shearing may be removed by filing or grinding, and test pieces 25 mm. in thickness and above may have the edges machined, but the test pieces are to receive no other preparation. The test pieces are not to be annealed unless the material from which they are cut is similarly annealed, in which case the test pieces are to be similarly and simultaneously treated with the material before testing.

(*c*) For small sectional material these bend tests may be made from the flattened bar.

4. **Bend Tests.**—(*a*) For temper bend tests the test pieces are to be heated to a blood red and quenched in water at a temperature not exceeding 27° C. The colour is to be judged indoors in the shade.

(*b*) For both cold and temper bends the test piece is to withstand, without fracture, being doubled over until the internal radius is equal to $1\frac{1}{2}$ times the thickness of the test piece, and the sides are parallel.

(*c*) Bend tests may be made either by pressure or by blows.

TESTS FOR SHIP STEEL.

Section 4. 1. **Number of Tensile Tests. Plates and Sectional Material.**—When the Surveyor is in constant attendance at the Steel Works one tensile test piece for plates or sectional material is to be taken from the finished material of each charge.

Where the quantity of the material from one charge exceeds 25 metric tons, a second tensile test will be required; also additional tests are to be made for every variation in thickness of 4 mm. in the plates or sectional bars from each charge.

2. **Tensile Tests.**—(*a*) **Plates.**—The tensile breaking strength of steel plates, determined from Standard test pieces, is to be between the limits of 41 and 50 kg. per mm². For plates specially intended for cold flanging and marked for identification, the tensile strength is to be between the limits of 41 and 47 kg. per mm². In the case of material for purposes in which tensile strength is not important, the tensile test may be dispensed with and the bend test only be made, if so specified by the builders and approved by the Committee. The elongation, measured on a Standard test piece having a gauge length of 200 mm., is not to be less than 20 per cent for material of 9,5 mm. in thickness and upwards, and not less than 16 per cent for material below 9,5 mm. in thickness.

(*b*) **Angles, Bulb Angles, Channels, and Similar Sections.**—The tensile breaking strength of angles, bulb angles, channels, and similar sectional material is to be between the limits of 41 and 50 kg. per mm². In the case of material for purposes in which tensile strength is not important, the tensile test may be dispensed with and the bend test only be made, if so specified by the builders and approved by the Committee. The elongation, measured on a Standard test piece having a gauge length of 200 mm., is not to be less than 20 per cent for material of 9,5 mm. in thickness and upwards, and not less than 16 per cent for material below 9,5 mm. in thickness.

3. **Occasional Attendance at Steel Works (Steel for Shipbuilding Purposes).**—(*a*) When the Society's Surveyor

is not in constant attendance at the Steel works, the Makers themselves may, with the written authority of the Society, comply with all the prescribed requirements, and furnish the Surveyor with a certificate to the effect that the Society's Rules as to the testing of steel have been complied with in the case of the material submitted for approval. The Surveyor is then to make check tensile, cold, and temper bend tests from not less than one plate or bar in every batch of 50 or less in number, provided the batch be all from one charge. Where more than one charge is represented, each charge is to be tested. Additional tests are also to be made for every variation in thickness of 4 mm. made from one charge. The test pieces are to be selected by the Surveyor from the plates or bars, and not from shearings previously detached from them, and when marked by the Surveyor for testing they are to be followed, as far as practicable, through the different stages of preparation until the tests are completed.

(*b*) Where the tests are unsatisfactory, the whole of the material from the charge is to be rejected, and the Surveyor is to see that the Society's brand is satisfactorily defaced.

TESTS FOR BOILER STEEL.

Section 5. All plates intended for cylindrical shells of pressure vessels which are to be welded, or where the thickness exceeds 45 mm., or where the internal diameters of the vessels are less than 100 times the thickness of the plates, should be efficiently normalised before the test pieces are cut off.

2. **Number of Tensile Tests**—(*a*) **Plates.**—One tensile test piece is to be taken from each plate as rolled. For plates exceeding 2500 kg. in weight one tensile test piece is to be taken from each end.

(*b*) **Angle, Tee and Stay Bars.**—One tensile test is to be made from each 15 or part of 15 bars rolled of each section or diameter from the same charge, but not less than two tensile tests are to be made unless the total number of bars rolled from the same charge is 8 or less than 8 and the bars are of the same section or diameter, in which case one tensile test will suffice. For round bars of 45 mm. diameter and under, the numbers 50 and 20 are to be substituted for 15 and 8 respectively for determining the number of tests required.

3. **Tensile Tests.** (*a*) **Plates.**—The tensile breaking strength of steel plates for shells and girders, determined from Standard test pieces, is to be between the limits of 44 and 55 kg. per mm^2., but a range of more than 6,3 kg. per mm^2. will not be permitted in any one case. For plates intended for flanging or welding, and for combustion chambers and furnaces, the tensile breaking strength is to be between the limits of 41 and 47 kg. per mm^2. The elongation, measured on a Standard test piece having a gauge length of 200 mm., is not to be less than 20 per cent for material of 9,5 mm. in thickness and upwards required to have a tensile breaking strength between the limits of 44 and 55 kg. per mm^2.; and not less than 23 per cent for material of 9,5 mm. in thickness and upwards required to have a tensile breaking strength between the limits of 41 and 47 kg. per mm^2.

(*b*) **Angle and Tee Bars.**—The tensile breaking strength of angle and tee bars is to be between the limits of 44 and 50 kg. per mm^2., with an elongation of not less than 20 per cent measured on the Standard test piece A.

For plates, angles, or tee bars under 9,5 mm. in thickness the elongation may be 3 per cent, but not more than 3 per cent below the prescribed elongations.

Wherever practicable the rolled surfaces are to be retained on two opposite sides of the test pieces.

(*c*) **Stay Bars.**—The tensile breaking strength of longitudinal stay bars is to be between the limits of 44 and 55 kg. per mm^2., with an elongation of not less than 20 per cent measured on the Standard test piece B, or 24 per cent measured on the Standard test piece C; but a range of not more than 6,3 kg. per mm^2. shall be permitted in any one case. For steel bars for combustion chamber stays the tensile breaking strength is to be between the limits of 41 and 47 kg. per mm^2. with an elongation of not less than 23 per cent measured on the Standard test piece B, or 28 per cent measured on the Standard test piece C.

(*d*) **Special Quality Steel for Boilers.**—When steel material is proposed having other tensile strength than that specified in this Section, the proposed limits of tensile strength and elongation should be submitted for consideration.

TESTS FOR RIVET BARS AND MANUFACTURED RIVETS.

Section 6. 1. **Testing of Material.**—All material from which rivets are manufactured is to be tested.

Rivets are not to be manufactured from steel or ingot iron bars in which the sulphur segregates and other non-metallic substances are concentrated in the core. To ensure this, a sulphur print is to be taken from the material of each

charge, and where the weight of bars as rolled from one charge exceeds 10 metric tons, additional sulphur prints may be taken.

2. **Number of Tests.**—(*a*) In the case of steel bars, one tensile test piece is to be taken from each charge used for rivet bars; but where the weight of bars as rolled from one charge exceeds 10 metric tons, an additional tensile test is to be made from each further 10 metric tons or portion thereof.

(*b*) In the case of wrought iron bars, two tensile tests shall be taken from every three metric tons or portion thereof in each batch of any order presented for inspection, except that, in the case of lots of one metric ton or less, one tensile test shall be accepted.

(*c*) In the case of ingot iron bars, one tensile test piece is to be taken from each charge used for rivet bars; but where the weight of bars as rolled from one charge exceeds 10 metric tons, an additional tensile test is to be made from each further 10 metric tons or portion thereof.

3. **Tensile Tests.**—(*a*) The tensile breaking strength of steel rivet bars is to be between the limits of 41 and 47 kg. per mm^2. of section with an elongation of not less than 25 per cent of the gauge length of eight times the diameter of the test piece, measured on the Standard test piece B, or 30 per cent measured on the Standard test piece C. The bars may be tested the full size as rolled.

(*b*) The tensile breaking strength of wrought iron rivet bars is to be between the limits of 33 and 39 kg. per mm^2. The elongation is to be not less than 22 per cent of the gauge length of eight times the diameter of the test piece, measured on the Standard test piece B.

(*c*) The tensile breaking strength of ingot iron rivet bars is to be between the limits of 33 and 39 kg. per mm^2., with an elongation of not less than 25 per cent of the gauge length of eight times the diameter of the test piece, measured on the Standard test piece B, or 30 per cent measured on the Standard test piece C. The bars may be tested the full size as rolled.

4. **Nicked Bend Tests.**—(*a*) In the case of wrought iron bars one nicked bend test shall be taken from each three metric tons of material or portion thereof in each batch of any order presented for inspection.

(*b*) The test pieces shall be lightly and evenly nicked on one side with a sharp cutting tool, and bent back at this point through an angle of 180°. They shall show a clean fibrous fracture, free from slag or dirt or any coarse crystalline structure.

5. **Manufactured Rivets.**—Rivets selected by the Surveyor from the bulk are to withstand the tests described hereafter.

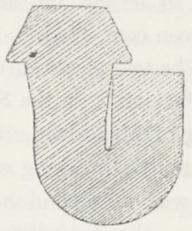


FIG. 1.

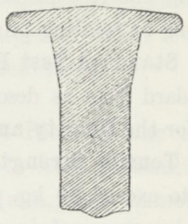


FIG. 2.

(*a*) The rivet shanks are to be bent cold, and hammered until the two parts of the shank touch in the manner shown in Fig. 1, without fracture on the outside of the bend.

(*b*) The rivet heads are to be flattened, while hot, in the manner shown in Fig. 2, without cracking at the edges. The heads are to be flattened until their diameter is $2\frac{1}{2}$ times the diameter of the shank.

(*c*) In the case of steel or ingot iron rivets, samples are to be selected by the Surveyor for examination by means of sulphur prints, to ensure that the material is free from marked central segregation.

SPECIAL QUALITY STEEL FOR SHIPBUILDING.
Regulations for Testing.

Section 7. 1. **Process of Manufacture.**—The steel is to be made by the Open Hearth Process, Acid or Basic, at works recognised by the Committee.

2. **Freedom from Defects.**—The finished material is to be free from cracks, surface flaws and laminations. It is also to have a workmanlike finish, and must not be hammer dressed.

3. **Testing and Inspection.**—The prescribed tests and inspections are to be made at the place of manufacture from the plates or bars in the condition in which they will be despatched; in the event of any of the material proving unsatisfactory in the course of being worked into the vessels, such material shall be rejected, notwithstanding any previous certificate of satisfactory testing, and such further tests of the material from the same charge may be made as the Surveyor may consider desirable.

All test pieces are to be selected by the Surveyor and tested in his presence, and he is to satisfy himself that the prescribed conditions are fulfilled.

4. **Tensile Test Pieces.**—The tensile strength, ductility, and limit of proportionality (as defined below) are to be determined from standard test pieces cut lengthways from

the bar, and 50 per cent lengthways and 50 per cent crossways from the plate.

Where material is annealed or otherwise treated before despatch, the test pieces are not to be cut off until the annealing or treating process has been completed.

5. **Standard Test Pieces.**—The test pieces are all to be of standard form as described in **Section 2** of the Society's Rules for the **Quality and Testing of Materials.**

6. **Tensile Strength.**—The tensile breaking strength is not to exceed 60 kg. per mm². with a range of not more than 8 kg. per mm². in any one case ; the elongation is to be not less than 20 per cent measured on a gauge length of 200 mm.

7. **Limit of Proportionality.**—The material must satisfy a test for limit of proportionality of not less than 24 kg. per mm²., the elastic properties being determined by means of a Ewing extensometer, or other approved extensometer, of 200 mm. gauge length. The tests shall be carried out as follows :—

(*a*) A load of 3 kg. per mm². of section shall be applied to the test piece and an extensometer reading taken.

(*b*) The load shall be increased to 24 kg. per mm². of section and a second reading taken.

(*c*) The load shall be reduced to 3 kg. per mm². and a third reading taken.

(*d*) The third reading shall not exceed the first reading by more than ·01 mm.

8. **Number of Test Pieces.**—One tensile test piece is to be made from at least every fifth plate or bar, as rolled, from each charge. This test piece is to be used for determining both the limit of proportionality and the tensile strength. The Surveyor should select a sample from each variation of thickness of 2,5 mm. in the plates or bars from each charge.

9. **Cold Bend Tests.**—A cold bend test is to be taken both lengthways and crossways from every plate (bars lengthways only). The test pieces are to withstand without fracture, being doubled over until the internal radius is equal to one and a half times the thickness of the test pieces and the sides are parallel.

10. **Preparation of Test Pieces.**—The test pieces are to be carefully prepared in the usual manner.

11. **Additional Tests before Rejection.**—Where any of the test pieces first selected by the Surveyor do not fulfil the above requirements, two further tests of the same kind may be made from the same plate or bar, but where either of these fail the plate or bar from which the test pieces were cut is to be rejected.

In addition to the tests described above, the material may be subjected to further tests at the discretion of the Surveyor.

12. **Branding.**—In addition to the Manufacturer's name or Trade Mark and the place where made, and the numbers and identification marks laid down by the Society's Rules, each plate or bar is to be distinctly branded in two places with the Society's brand LR. and, in addition, with letters SPL., thus :—LR. SPL. in one stamp.

13. **Defacing of Material.**—In the event of the material failing, the brand is to be defaced in the usual manner.

14. **Submission of Plans.**—When it is desired to use this material in the construction of vessels intended to be classed in the Society's Register Book, plans showing the reduction of scantlings proposed should be submitted for the consideration of the Committee.

15. **Alternative Proposals.**—The Committee will consider proposals for the use of special quality steel having limits different from those prescribed above, provided full particulars as to the properties and manufacture of the material are submitted for consideration.

SPECIAL IRON FOR SCREW STAYS FOR COMBUSTION CHAMBERS.

Section 8. General.—In order that iron screw stays may be approved of the same size as would be required for mild steel the iron must withstand the tests described hereafter.

1. **Number of Tensile Tests.**—The bars as rolled are to be placed in batches of 20, and one tensile test piece is to be taken from each batch. If this is unsatisfactory, two other bars are to be selected for test, but should either of these fail the batch is to be rejected.

2. **Tensile Test.**—The tensile breaking strength is not to be less than 34 kg. per mm²., with an elongation of not less than 25 per cent measured on the Standard test piece B, or of 30 per cent measured on the Standard test piece C.

3. **Bend Tests.**—(*a*) Test pieces, either of the bar as rolled or turned down to 25 mm. diameter, are to stand bending cold until the sides are parallel and the space between the two sides is not greater than the diameter of the test piece.

(*b*) One ordinary bend test piece is to be taken from each batch, and a similar test piece from each batch is to be lightly and evenly nicked on one side with a sharp

cutting tool and bent back at this point through an angle of 180° by pressure or by a succession of light blows. The fracture must be clean, fibrous, free from slag or dirt or any coarse crystalline structure. If either of these tests is unsatisfactory, two other bars are to be selected for test, but should either of these fail the batch is to be rejected.

QUALITY AND TESTING OF STEEL CASTINGS.

Section 9. 1 **Process of Manufacture.**—Steel for castings is to be made by the Open Hearth process, Acid or Basic, or by such other process as may be approved by the Committee.

2. **Heat Treatment.**—All steel castings are to be thoroughly heat treated in a properly constructed furnace, which must permit of the whole casting being uniformly raised in temperature throughout its whole extent to the necessary intensity. The casting is to be allowed to cool prior to removal from the furnace, and if afterwards heated for any purpose it is again to be similarly heat treated if required by the Surveyor.

3. **Testing and Inspection.**—(*a*) The tests and inspections hereafter described are to be made, preferably at the place of manufacture prior to despatch, but in the event of any casting proving unsatisfactory in the course of preparation or erection, such casting is to be rejected notwithstanding any previous certificate of satisfactory testing.

(*b*) The tensile strength and ductility are to be determined from standard test pieces, which are to be prepared from pieces cast on the casting. These pieces are not to be cut or partially cut from the castings until the heat treatment of such castings has been completed, nor until they have been stamped by the Surveyor. The test pieces are to be stamped by the Surveyor after the heat treatment. All test pieces are to be selected by the Surveyor and tested in his presence, and he is to satisfy himself that the conditions herein described are fulfilled.

(*c*) Where the castings are to be used for purposes for which cast iron is ordinarily employed they need not be submitted to tensile and bend tests, but they are to be submitted to the hammering tests specified in **clause 12.**

4. **Number of Tests.**—At least one tensile test and one cold bend test are to be taken from each casting. In castings of complex design, referred to in **clause 11,** at least two tensile and two cold bend tests are to be taken. Where a casting is made from more than one charge of steel, at least four tensile and four cold bend tests are to be taken from pieces cast as far apart as possible on the casting, some test pieces being taken from as near the top, and others from as near the bottom of the casting as practicable.

5. **Dimensions of Tensile Test Pieces.**—The tensile test pieces are to be turned so as to have a diameter of 14 mm. with a gauge length of 50 mm., or a diameter of 20 mm. with a gauge length of 75 mm. or a diameter of 25 mm. with a gauge length of 90 mm.

6. **Tensile Tests.**—The tensile breaking strength determined from test pieces of standard dimensions is to be between the limits of 41 and 55 kg. per mm². with an elongation of not less than 20 per cent measured on the standard test piece.

7. **Dimensions of Bend Test Pieces.**—The bend test pieces are to be machined to a rectangular section 25 mm. wide by 19 mm. thick, with the edges rounded to a radius of 1,5 mm. They are to be bent over the thinner section. The bending may be performed either by pressure or by blows.

8. **Bend Tests.**—The bend test pieces are to withstand, without fracture, being bent cold through an angle of 120 degrees, the internal radius of the bend being not greater than 25 mm.

9. **Additional Tests before Rejection.**—Where either the tensile or bend test or both fail, and the Surveyor considers the fractured test piece or test pieces, or the results obtained therefrom, do not fairly represent the quality of the casting, duplicates of the test or tests which failed are to be made if requested by the Maker. In such cases the quality of the casting is to be judged by the result of the duplicate test or tests and not by the original test or tests which failed.

10. **Percussive Tests.** — Stern frames cast in one piece are to be let fall on hard ground (excavations being made to take bosses and other projections) after being raised through an angle of 45 degrees. Stern frames cast in more than one piece, rudders, steering quadrants, crossheads and tillers, are to be dropped on hard ground from a height of from 2 m. to 3 m. according to the design, shape, and weight of the casting.

11. **Castings of Complex Design.**—Castings of complex design which would be liable to be deformed if submitted to the drop or percussive test, may have this test dispensed with provided two tensile and two cold bend tests are made upon pieces taken from positions as far apart as possible on each casting; one tensile and one bend test being taken from as near the top and the others from as near the bottom of the casting as practicable.

12. **Hammering Tests.**—All castings are to be slung up and well hammered to satisfy the Surveyors that the casting is sound and without flaw. For large castings the hammer used for this test is to be not less than 3 kg. weight. In the case of castings which are subjected to the percussive tests mentioned in **clause 10,** the hammering tests are to be applied after the percussive tests.

13. **Drilling Tests.**—In the case of large steel castings the Surveyors are to supplement the foregoing tests by drilling small holes at such parts of the castings where experience shows that cavities and contraction cracks are most likely to occur, and at positions which are to be agreed upon between the Surveyor and the Manufacturer, in order to determine the soundness or otherwise of the casting. These holes are afterwards to be tapped and properly filled up with screw plugs.

14. **Branding.**—Every casting after it has withstood satisfactorily the prescribed tests, is to be clearly and distinctly marked by the Society's Surveyor indicating that the casting has complied with the Society's requirements.

QUALITY AND TESTING OF INGOT STEEL FORGINGS.

Section 10. 1. **Process of Manufacture.**—(*a*) Ingot steel for forgings is to be made by the Open Hearth process, Acid or Basic, or by such other process as may be approved by the Committee.

(*b*) The forgings are to be sound; they are to be made from sound ingots, and for all important forgings such as stern frames, rudder heads and main pieces of rudders upon which arms are shrunk, crank and other shafts, connecting rods and piston rods, the forgings are to be gradually and uniformly forged. The sectional area of the body of the forging (as forged) is not to exceed one-fifth of the sectional area of the original ingot, and no part of the forging (as forged) is to have more than two-thirds of the sectional area of the original ingot.

2. **Heat Treatment.** — All important ingot steel forgings are to be suitably heat treated in a properly constructed furnace, which must permit of the whole forging being uniformly raised in temperature throughout its whole extent to the necessary intensity. If the forging be subsequently heated for any further forging, it is again to be similarly heat treated if required by the Surveyor.

3. **Testing and Inspection.**—(*a*) The tests and inspections hereafter described are to be made, preferably at the place of manufacture prior to despatch, but in the event of any forging proving unsatisfactory in the course of preparation or erection, such forging is to be rejected notwithstanding any previous certificate of satisfactory testing.

(*b*) The tensile strength and ductility are to be determined from standard test pieces which are to be prepared from sample pieces cut lengthwise from the forging from a part of not less sectional dimensions than the body of the forging. Such standard test pieces are to be machined from the sample pieces without forging down, and the sample pieces are not to be detached from the forging until the heat treatment of such forging has been completed. The test pieces are to be stamped by the Surveyor after the heat treatment. All test pieces are to be selected by the Surveyor and tested in his presence, and he is to satisfy himself that the conditions herein described are fulfilled.

4. **Number of Tests.**—At least one tensile and one cold bend test piece are to be taken from each forging. Where a number of articles are cut from one forging, one tensile and one cold bend test from this whole forging will be sufficient.

5. **Dimensions of Tensile Test Pieces.**—The tensile test pieces are to be turned so as to have a diameter of 14 mm. with a gauge length of 50 mm., or a diameter of 20 mm. with a gauge length of 75 mm., or a diameter of 25 mm. with a gauge length of 90 mm.

6. **Tensile Tests.**—(*a*) The tensile breaking strength determined from test pieces of standard dimensions is to be between the limits of 44 and 63 kg. per mm^2., with a range not exceeding 6,3 kg. per mm^2 in any one forging with an elongation on the standard test piece of not less than 29 per cent for 44 kg. steel, and 17 per cent for 63 kg. steel; for steels of intermediate strength the elongation should be proportional.

(*b*) Stern posts, propeller posts, rudders, and other ship forgings which are to be welded may be made of specially soft Open Hearth Ingot Steel instead of wrought iron, such steel to have a tensile breaking strength between the limits of 35 and 41 kg. per mm^2., with an elongation on the standard test piece (**Sec. 10, clause** 5) of not less than 35 per cent for 35 kg. steel and 31 per cent for 41 kg. steel; for steel of intermediate strength the elongation should be proportional. The remaining tests and requirements are to be as prescribed for ordinary ingot steel.

7. **Dimensions of Bend Test Pieces.**—The bend test pieces are to be machined to a rectangular section 25 mm. wide by 19 mm. thick, with the edges rounded to a radius of 1,5 mm. They are to be bent over the thinner section. The bending may be performed either by pressure or by blows.

8. **Bend Tests.**—The bend test pieces are to withstand without fracture being bent cold through an angle of 180 degrees, the internal radius of the bend being not greater than 6 mm.

9. Where it is proposed to use ingot steel forgings of material of tensile strength other than specified above, the proposed limits of tensile strength and elongation and the radius of curvature for bend tests should be submitted for consideration.

10. **Additional Tests before Rejection.**—Where either the tensile or bend test, or both, fail, and the Surveyor considers the fractured test piece or test pieces, or the results obtained therefrom, do not fairly represent the quality of the forging, duplicates of the test or tests which failed are to be made if requested by the Maker. In such cases the quality of the forging is to be judged by the result of the duplicate test or tests and not by the original test or tests which failed.

11. **General.**—The requirements as to heat treatment and testing are intended to apply to rudder heads and main pieces of rudders upon which arms are shrunk, to shafts of all descriptions, also to connecting rods and piston rods which require to be made in several heats. They are not intended to apply to small forgings which during their last stage of manufacture are uniformly heated throughout.

12. **Special Quality Steel for Forgings.**—Where steel material is proposed having other tensile strength than that specified in this Section, the particulars of the mechanical properties of the material should be submitted for consideration.

13. **Forged Drums and Rotors.**—In the case of forged drums and rotors which rotate at high speed, longitudinal, tangential and radial tensile, bend and impact tests should be made, and the proposed limits should be submitted for consideration.

14. **Branding.**—Every forging, after it has withstood satisfactorily the prescribed tests, is to be clearly and distinctly marked by the Society's Surveyor indicating that the forging has complied with the Society's requirements.

QUALITY AND TESTING OF BRONZE PROPELLERS AND BRONZE PROPELLER BLADES.

Section 11. 1. **Number of Tests.**—At least one tensile test is to be taken from each casting.

2. **Dimensions of Test Piece.**—The tensile test pieces are to be turned so as to have a diameter of 14 mm. or 20 mm., with a gauge length of 50 mm.

3. **Tensile Tests.**—The tensile breaking strength determined from test pieces of standard dimensions is to be not less than 44 kg. per mm^2 and the percentage of elongation measured on the standard test piece plus 0·635 times the tensile breaking stength, is to be not less than 48. In no case, however, is the percentage of elongation to be less than 15.

QUALITY AND TESTING OF ANCHORS FOR STEAM VESSELS, SAILING VESSELS AND TUGS.

Section 12. 1. **Process of Manufacture.**—(*a*) Anchors are to be made of forged wrought iron, or forged open hearth ingot steel, or cast steel; the use of Bessemer steel is prohibited.

(*b*) Each important part of a forged anchor is to be plainly marked by the makers with the words "Forged Wrought Iron," or "Forged Open Hearth Ingot Steel," as the case may be.

(*c*) Steel Anchor Shackles are to be forged and unwelded.

2. **Tests of Anchors.**—All anchors, including Stream and Kedge anchors weighing more than 76 kg. inclusive of stock, are to be tested in accordance with the requirements of the following table and the Certificates of Test produced.

WEIGHTS AND CORRESPONDING PROOF STRAINS OF ANCHORS.

Weight.	Test.	Weight.	Test.	Weight.	Test.	Weight.	Test.	Weight.	Test.	Weight.	Test.
kg.	kg.	kg.	kg.	kg.	kg.	kg.	kg.	kg.	kg.	kg.	kg.
65	3730	370	9630	735	16290	1525	29060	2475	42190	4800	66180
75	3950	380	9790	760	16730	1550	29460	2515	42720	4825	66380
90	4280	395	10080	775	16980	1575	29820	2590	43680	4980	67580
100	4550	405	10240	825	17820	1625	30550	2665	44580	5080	68330
115	4830	420	10540	850	18270	1650	30970	2770	45800	5155	68880
125	5050	430	10740	865	18560	1675	31320	2860	46910	5310	70060
140	5340	445	11030	890	18910	1700	31720	2945	47980	5360	70410
150	5550	460	11330	950	19930	1730	32130	3050	49160	5535	71720
165	5790	470	11480	965	20160	1805	33280	3125	49940	5560	71920
180	6030	485	11780	1040	21470	1830	33640	3240	51170	5765	73440
190	6240	495	11930	1065	21920	1855	33950	3300	51800	5995	75200
205	6480	510	12230	1080	22150	1895	34460	3455	53440	6225	76710
215	6690	520	12380	1120	22750	1930	35040	3480	53760	6450	78120
230	6980	535	12630	1145	23140	1970	35520	3655	55600	6705	79740
240	7200	545	12830	1180	23660	1980	35650	3685	55900	6960	81330
255	7490	560	13080	1195	23900	2030	36300	3860	57640	7215	82910
265	7650	570	13280	1245	24690	2070	36880	3910	58140	7495	84630
280	7940	585	13570	1270	25140	2135	37790	4065	59440	7775	86370
290	8090	595	13780	1295	25540	2160	38100	4130	60060	8075	87860
305	8380	610	14080	1345	26400	2250	39390	4240	61200		
320	8670	635	14530	1410	27330	2285	39870	4345	62260		
330	8890	660	14980	1425	27560	2335	40460	4420	62850		
345	9170	685	15380	1450	27970	2425	41590	4570	64250		
355	9390	710	15830	1500	28710	2440	41770	4620	64600		

The weight given in the above table is either for stockless anchors or for the ordinary type excluding stock.
For intermediate weights of anchors the tests may be obtained by interpolation.

CAST STEEL ANCHORS.

Section 13. 1. **General.**—All cast steel anchors in addition to undergoing the statutory tests are to be subjected to the percussive, hammering and bending tests given below.

These tests are to be carefully and completely made in the presence and to the satisfaction of the Society's Surveyors.

2. **Percussive Test.** — (*a*) The anchor, or where anchors are made in more than one piece, each piece is to be raised a given height and then dropped on a steel or iron slab.

For weights of 760 kg. and below, the height is to be 4,60 m., and for weights above 760 kg. the height is to be 3,65 m.

The lowest part of the anchor or piece when suspended is to be at least the given height above the iron slab upon which it is to be dropped.

(*b*) An anchor of the Admiralty pattern is first to be raised vertically to the given height with its shank and arms in a horizontal position, and then let fall from that height.

It is then to be raised a second time to the given height and suspended with the crown downwards. Two steel or iron blocks are to be placed underneath it, and the anchor is to be let fall from this position so that one of the blocks receives it on the middle of one arm, and the other block receives it on the middle of the other arm.

(*c*) The slab for the horizontal test is to be of steel or iron, well laid on a solid concrete foundation to the satisfaction of the Surveyor.

(*d*) If the slab on which the anchor falls is broken by the impact the test is to be repeated until a slab is made that does not break.

(*e*) The blocks for the vertical test are to be solid and of sufficient height to prevent the crown of the anchor from touching the slab, and are to be to the satisfaction of the Surveyor.

3. **Hammering Test.**—Providing the percussive test has been satisfactory, the anchor or piece is to be slung and thoroughly hammered over its parts with a sledge hammer weighing not less than 3 kg., and is required to give under this treatment such a clear ring in all its parts as shall satisfy the Surveyor that the casting is sound and that no flaws have developed by the application of the preceding percussive tests.

4. **Bending Test.**—(*a*) Cast steel may be passed as sufficiently ductile for anchors when a piece of each casting, 200 mm. in length, is cut from the casting, turned to 25 mm. in diameter, and is then bent cold by hammering through an angle of 90 degrees over a radius of 38 mm., without showing signs of flaw or fracture.

(*b*) A piece is to be cast on each cast steel anchor, or on each portion of such anchor when it is made of more than one casting, and each piece is to be of sufficient size to enable one test piece of the size stated above to be cut out of it, or it may be (at the discretion of the Manufacturer) of sufficient size to enable four test pieces to be cut out of it.

Where it is only of sufficient size to enable one test piece to be cut out of it, that piece is to be subjected to the bending test named in paragraph (*a*) above, and should it fail to withstand the test the casting is to be rejected.

Where the piece is large enough to enable four test pieces to be cut out of it, one of these is to be turned in a lathe to 25 mm. in diameter for a length of 200 mm., and bent cold through an angle of 90° over a radius of 38 mm., and should the piece withstand this test without flaw or fracture it shall be deemed to have withstood a satisfactory test for ductility.

Should the one test piece not pass this test, all or any of the other three test pieces may be tested in a similar manner, and should any one of the four test pieces pass this test, the anchor, or part of the anchor, as the case may be, shall be deemed so far satisfactory.

5. **Annealing.**—Each anchor is to be properly and sufficiently annealed, and when so annealed stamped "Annealed Steel." Annealing is not to be regarded as proper, or efficient, unless the process extends from three days for small anchors up to six days for large ones.

TESTS FOR CHAIN CABLES AND STREAM CHAINS.

Section 14. 1. **Tests for Chain Cables and Stream Chains.**—(*a*) All stud link chain cables and stream chains are to be tested in accordance with the requirements of the following Table and the certificates of test produced.

Stud Link Chain Cables.

Minimum Size.	Proved to Statutory Test.	Breaking Test.	Minimum Weight per length of 30 metres.	Minimum Size.	Proved to Statutory Test.	Breaking Test.	Minimum Weight per length of 30 metres.
mm.	kilos.	kilos.	kilos.	mm.	kilos.	kilos.	kilos.
11	3450	5180	95	50,5	72300	101230	1640
13	4570	6860	125	52	76580	107200	1745
14,5	5710	8530	145	54	82640	115600	1875
16	7110	10660	175	55,5	87330	122180	1990
17,5	8670	13010	200	57	92090	128800	2090
19	10240	15290	235	58,5	97000	135800	2205
20,5	11900	17840	280	60	102000	142800	2320
22	13700	20550	315	62	108900	152500	2480
23,5	15640	23460	365	63,5	114300	160000	2605
25	17720	26570	410	65	118200	165500	2730
27	20640	30920	480	66,5	122200	171100	2870
28,5	23010	34510	535	68	126100	176600	3000
30	25520	38210	595	69,5	130400	182400	3145
31,5	28130	42110	655	71	133800	187400	3280
33	30860	46300	720	73	139700	195600	3470
35	34700	52050	810	74,5	143600	201000	3620
36,5	37690	56480	880	76	147300	206300	3770
38	40940	59350	950	77,5	151100	211500	3925
39,5	44160	61770	1025	79	154800	216600	4075
41	47630	66700	1100	81	160400	224500	4285
42,5	51200	71700	1175	82,5	164100	229800	4445
44	54880	76800	1265	84	167500	234400	4610
46	59970	83940	1375	85,5	171000	239300	4795
47,5	63940	89470	1470	87	174300	243900	4965
49	68000	95200	1550	89	179600	251400	5200

(*b*) Unstudded close-link chains will be accepted as cables if tested in accordance with the requirements of the following Table and the certificates of test produced.

SHORT LINK CHAIN CABLES.

Minimum Size.	Proved to Statutory Test.	Breaking Test.	Minimum Weight per length of 30 metres.	Minimum Size.	Proved to Statutory Test.	Breaking Test.	Minimum Weight per length of 30 metres.
mm.	kilos.	kilos.	kilos.	mm.	kilos.	kilos.	kilos.
11	2240	4480	110	31,5	18740	37480	700
13	3190	6380	140	33	20520	41040	770
14,5	3920	7840	165	35	23090	46180	865
16	4780	9560	190	36,5	25140	50280	940
17,5	5760	11520	220	38	27280	54560	1010
19	6820	13640	260	39,5	29420	58840	1090
20,5	7920	15840	305	41	31700	63400	1175
22	9110	18220	345	42,5	34090	68180	1260
23,5	10390	20780	395	44	36790	73580	1360
25	11800	23600	445	46	39950	79900	1490
27	13710	27420	515	47,5	42580	85160	1595
28,5	15290	30580	575	49	45320	90640	1700
30	16980	33960	635	50,5	48180	96360	1810

TESTS FOR STEEL WIRE TOWLINES, HAWSERS AND WARPS, AND STANDING RIGGING.

Section 15. 1. **General.**—Each Manufacturer is required to provide on his premises machines suitable for making the prescribed tests satisfactorily, and the works are to be at all times open to the inspection of the Society's Surveyors, who are empowered to retest any rope for which a certificate has been issued by the Manufacturer.

2. **Certificates.**—Printed forms of certificates, approved by the Committee, are to be signed by the Manufacturers, and will be supplied to them upon application to the Secretary.

3. **Quality of Ropes.**—The Rules set forth hereunder apply to four qualities of galvanised steel wire ropes, one of which is suitable for steel wire standing rigging, and is composed of six strands of seven wires each. No fibre is to be used in the strands, a fibre core only being fitted.

The other three qualities of rope are for towlines, hawsers and warps, and are designated respectively :—flexible steel wire rope, which is composed of 6 strands of 12 wires each ; special flexible, in which 6 strands of 24 wires each are used ; and special flexible which has 6 strands of 30 wires each, a fibre core being fitted in each strand.

4. **Tests.**—A portion of each steel wire rope is required to stand the tensile test prescribed in the Table, and may be pulled as a finished rope, or a short length of each of the wires composing the finished steel rope may be tested separately, in which case the minimum breaking load of the rope shall be considered to be the sum of the aggregate breaking loads of the individual wires, less a percentage for laying up, as follows :—

6 × 7	.....	5 per cent.
6 × 12	.....	7½ „
6 × 24	.....	10 „
6 × 30	.....	12½ „

Each wire will be required to be capable of being twisted round itself not less than nine times, and of being untwisted eight times and straightened without breaking or splitting.

SIZES AND BREAKING TESTS OF STEEL WIRE ROPES.

Circumference of Ropes.	Standing Rigging Wire Ropes. (*a*)	Galvanised Flexible Wire Ropes. (*b*)	Galvanised Special Flexible Wire Ropes.	
			(*c*)	(*d*)
	6×7	6×12	6×24	6×30
mm.	Kilogs.	Kilogs.	Kilogs.	Kilogs.
25	1830	2030	2640	2640
32	2950	3150	4470	3660
38	4270	4880	6200	5490
44	5890	6500	8840	7620
51	7720	8430	11380	10160
57	9650	10970	14940	13000
64	11990	13410	18000	15450
70	14530	15450	21440	19920
76	17370	18900	26120	23880
83	20430	22050	30180	26000
89	23780	26110	35770	30580
95	27330	29770	40540	35460
102	30790	33730	45620	40750
108	34850	36800	52330	46330
114	39120	44000	59550	52230
121	43690	47750	65640	58520
127		53640	72040	65240
133			78760	72350
140			85750	77840
146			92960	83600
152			100700	93580
159			106200	99900
165			114100	106400
172			122200	113000
178			132800	121900
190				133900
203				151200

QUALITY AND TESTING OF STEEL FOR STEAM, FEED, AIR AND OIL PRESSURE PIPES, AND SMOKE TUBES.

Section 16. 1. **Material.**—The steel is to be made by the open hearth process.

2. **Tests for Steam Pipes, Feed Pipes and Compressed Air Pipes.**—(*a*) **Lap Welded and Riveted.**—The tensile strength of the steel is not to exceed 44 kg. per mm^2., with a minimum elongation of 25 per cent on a Standard test piece having a gauge length of 200 mm.

(*b*) **Solid Drawn.**—The tensile strength of the steel is not to exceed 44 kg. per mm^2., with a minimum elongation of 20 per cent on a Standard test piece having a guage length of 200 mm.

3. **Tests for Oil Pressure Pipes.—Solid Drawn.**—The tensile strength of the steel is not to exceed 44 kg. per mm^2., with a minimum elongation of 20 per cent on a Standard test piece having a gauge length of 200 mm.

4. **Tests for Smoke Tubes.—Lapwelded and Seamless.**—The tensile strength of the material is not to exceed 44 kg. per mm^2., with a minimum elongation of 20 per cent on a Standard test piece having a gauge length of 200 mm.

71, FENCHURCH STREET, LONDON, E.C.3.

29*th October*, 1936.

By order of the Committee,

MALCOLM K. SCOTT,

Secretary.

LLOYD'S REGISTER OF SHIPPING.

STEEL MANUFACTURERS.

The following firms having applied to have the steel produced by them tested by a Surveyor to this Society and their mode of procedure reported upon, their applications have been complied with and the Surveyors' reports found satisfactory by the Committee.

Firms in Great Britain and Ireland.

Allen, Edgar, & Co., Lim., Imperial Steel Works, Tinsley, Sheffield. (*Steel castings.*)

Appleby-Frodingham Steel Co., Lim., Scunthorpe, Lincs.,

Appleby Works. (*Steel plates and blooms.*)

Frodingham Works. (*Sections, bars and blooms.*)

Atlas (The) Steel Foundry and Engineering Co., Lim., Armadale, West Lothian. (*Steel castings.*)

Babcock & Wilcox, Lim., Renfrew. (*Small steel castings.*)

Baird, Archibald, & Son, Lim., Hamilton, near Glasgow. (*Steel castings.*)

Baker Bessemer, J., Lim., Kilnhurst Steel Works, near Rotherham. (*Ingots and forgings.*)

Barrow Hæmatite Steel Co., Lim., Barrow-in-Furness.

Beardmore, William, & Co., Lim., Parkhead, Glasgow.

Blackett, Hutton & Co., Cleveland Steel and Iron Works, Guisborough, Yorkshire. (*Steel castings.*)

Bond's Foundry Co., Tow Law, Co. Durham. (*Small steel castings.*)

Braby, Fredk., & Co., Lim., Eclipse Iron and Galvanizing Works, Glasgow. (*Rolling Mills for plates up to* 6,5 *mm. in thickness.*)

Brown, Bayley's Steel Works, Lim., Sheffield. (*Steel ingots, forgings, and bars.*)

Brown, Lenox & Co., Lim., Pontypridd. (*Steel castings.*)

Brymbo (The) Steel & Ingot Iron Works, near Wrexham, Denbighshire. (*Steel ingots, billets and bars.*)

Cargo Fleet Iron Co., Lim., Cargo Fleet, near Middlesbro'-on-Tees. (*Sections and bars.*)

Carntyne Steel Castings Co., Lim., Moorpark, Renfrew. (*Steel castings.*)

Catton & Co., Lim., Yorkshire Steel Foundry, Hunslet, Leeds. (*Steel castings.*)

Clyde Alloy Steel Co., Lim., Craigneuk Works, Flemington, Motherwell. (*Steel castings.*)

Coghlan Steel & Iron Co., Lim., Hunslet Forge, Leeds. (*Rolling Mills for bars; forgings.*)

Coltness Iron Co., Lim., Newmains, Lanarkshire. (*Steel castings.*)

Colvilles Lim.,

Dalzell Steel and Iron Works, Motherwell, Lanarkshire.

Clydebridge Steel Works, Cambuslang, near Glasgow.

Glengarnock Iron and Steel Works, Glengarnock, Ayrshire. (*Sections and bars.*)

Consett Iron Co., Lim., Blackhill, Durham.

Cook, Joseph, Sons & Co. (1930), Lim., Washington Steel & Iron Works, Washington Station S.O., co. Durham. (*Steel castings.*)

Crofts (Engineers), Lim., Thornbury, Bradford. (*Steel castings.*)

Darlington Forge Co., Lim., Darlington. (*Steel castings and forgings.*)

Darlington Rolling Mills Co., Lim., Darlington. (*Rolling Mills for small sections and bars.*)
Davy & United Roll Foundry, Lim., Empire Works, Haverton Hill, Middlesbrough. (*Small steel castings.*)
Dorman, Long & Co., Lim. (Incorporating Bolckow, Vaughan & Co., Lim.),
Britannia Steel Works, Middlesbrough.
Cleveland Iron and Steel Works, South Bank-on-Tees.
Redcar Iron and Steel Works, Redcar.
English Steel Corporation, Lim.,
North Street Works, Openshaw, Manchester. (*Steel castings, forgings, bars and plates up to* 12,5 *mm. in thickness.*)
Vickers Works, Sheffield. (*Steel ingots, blooms, bars, forgings and castings.*)
Cammell Laird's Grimesthorpe Works, Sheffield. (*Steel ingots, forgings and castings.*)
Etna Iron and Steel Co., Lim., Motherwell, Lanarkshire. (*Rolling Mills for sections and bars.*)
Firth, Thomas, & John Brown, Lim.,
Atlas Works, Sheffield. (*Ingots, forgings, rolled bars and billets.*)
Norfolk Works, Sheffield. (*Steel castings and rolled strips.*)
Scunthorpe Works, Scunthorpe, Lincs. (*Steel castings.*)
Fox (Samuel) & Co., Lim., Stocksbridge Works, near Sheffield. (*Steel ingots.*)
Glanmor Foundry Co., Llanelly. (*Steel castings.*)
Guest, Keen & Nettlefolds, Lim.,
Castle Works, Rogerstone, near Newport, Mon. (*Rolling Mills for rivet and stay bars.*)
Cwmbran Works, near Newport, Mon. (*Rolling Mills for flat, round and angle bars.*)
Guest Keen Baldwins Iron & Steel Co., Lim.,
Port Talbot Steel Works, Port Talbot, South Wales.
Margam Steel Works, Port Talbot. (*Steel ingots and billets.*)
East Moors Steel Works, Cardiff. (*Steel ingots, blooms and billets; sections and bars.*)
Hadfields, Lim., East Hecla Works, Sheffield. (*Steel castings.*)
Hamilton, A., & Sons, Lim., Victoria Foundry, East Moors, Cardiff. (*Small steel castings.*)
Head, Wrightson & Co., Lim., Thornaby-on-Tees. (*Steel castings.*)
Hopkinsons, Lim., Britannia Works, Huddersfield, Yorkshire. (*Steel castings.*)
Hyde (Robert) & Son, Lim., North Stafford Steel Works, Stoke-on-Trent. (*Small steel castings.*)
Industrial Steels, Lim., Stevenson Road, Sheffield. (*Steel ingots, blooms, billets and bars.*)
Jackson, P. R., & Co., Lim., Salford, Manchester. (*Steel castings.*)
Jessop, W., & Sons, Lim., Brightside Works, Sheffield. (*Steel ingots, blooms, bars, forgings and castings.*)
Jopling, E., & Sons, Pallion, Sunderland. (*Steel castings.*)
Kirkstall Forge Lim., Leeds. (*Rolling Mills for bars.*)
Kryn & Lahy (1928), Lim., Letchworth, Hertfordshire. (*Steel castings.*)
Lake & Elliot, Lim., Proprietors of the Braintree Castings Co., Braintree, Essex. (*Small steel castings.*)
Lanarkshire Steel Co., Lim., Motherwell, Lanarkshire.
Lancashire Steel Corporation, Lim., Irlam, Manchester. (*Billets, bars, sections, and steel castings*);
Pearson & Knowles Works, Warrington, Lancs. (*Rolling Mills for sections and bars.*)
Lilleshall Co., Lim., Priors Lee Hall, nr. Shifnal, Salop. (*Rolling Mills for sections and bars.*)
Lloyd, F. H., & Co., Lim., James Bridge, near Wednesbury, Staffordshire. (*Steel castings.*)
Lysaght, John, Lim., Scunthorpe, Lincs. (*Steel ingots, billets and slabs.*)
Mills, Exors. of James, Lim., Bredbury Steel Works & Rolling Mills, near Stockport. (*Rolling Mills for steel bars.*)
Monk Bridge Iron & Steel Co., Lim., Leeds. (*Rolled bars and forgings.*)
Monks, Hall & Co., Lim., Warrington. (*Rolling Mills for bars.*)
National Steel Foundry (1914), Lim. (The), Kirkland Works, Leven, Fifeshire. (*Steel castings.*)
Newport and South Wales Tube Co., Lim., Landore, S. Wales. (*Weldless rolled or drawn steel hollow pillars and davits.*)
North British (The) Steel Foundry, Lim., Balbardie Steel Works, Bathgate. (*Small steel castings.*)

Osborn, S., & Co., Clyde Steel & Iron Works, Sheffield. (*Steel castings.*)
Park Gate Iron & Steel Co., Lim., Rotherham, Yorkshire.
Patent Shaft & Axletree Co., Lim., Wednesbury, Staffordshire.
Raine & Co., Lim., Delta Iron & Steel Works, Derwenthaugh, Newcastle-on-Tyne. (*Rolling Mills for sections and bars.*)
Redheugh Iron & Steel Co. (1936), Lim., Teams, Gateshead-on-Tyne. (*Rolling Mills and Steel Foundry.*)
Renton & Fisher, Lim., Hopetoun Steel Works, Bathgate. (*Steel castings.*)
Round Oak Steel Works, Lim., Brierley Hill, Staffordshire. (*Sections and bars.*)
Rowlands, F. W., & Co., Seacombe, Cheshire. (*Small steel castings.*)
Scottish Iron & Steel Co., Lim., Coatbridge, Lanarkshire.
Northburn Works. (*Steel ingots and billets, sections and bars.*)
Waverley Works. (*Sections and bars.*)
Victoria Works. (*Sections and bars.*)
Woodside Works. (*Sheets and strips.*)
Coats Works. (*Sections and bars.*)
Rochsolloch Works. (*Sections and bars.*
Shaw, W., & Co., Middlesbro'-on-Tees. (*Steel castings.*)
Shelton Iron, Steel & Coal Co., Lim., Stoke-on-Trent. (*Steel ingots, billets, bars and sections.*)
Skinningrove Iron Co., Lim., Skinningrove Iron Works, Saltburn-by-the-Sea. (*Sections and bars.*)
Smith & McLean, Lim., Mossend, and Gartcosh, Lanarkshire. (*Rolling Mills for plates up to 8 mm. in thickness.*)
South Durham Steel & Iron Co., Lim., West Hartlepool.
Springfield Steel Co., Lim., 1323, London Road, Glasgow. (*Steel castings.*)
Steel Company of Scotland, Lim., Newton, Glasgow; and Blochairn, Glasgow.
Steel, Peech & Tozer, Lim., Sheffield. (*Steel ingots, blooms, forgings, rivet and stay bars.*)
Stewarts & Lloyds, Lim. (Clydesdale Steel and Iron Works), Mossend, Lanarkshire. (*Steel ingots only.*)
„ „ „ Sun Foundry, Coatbridge, Lanarkshire. (*Steel castings.*)
„ „ „ Alfred Hickman Branch, Bilston, Staffordshire.
Stockton Steel Foundry Co., Lim., Stockton-on-Tees. (*Steel castings.*)
Summerson, Thomas, & Sons, Lim., Darlington. (*Small steel castings.*)
Thomas (Richard) & Co., Lim., Redbourn Works, Scunthorpe, Lincolnshire. (*Steel ingots and billets.*)
United Strip and Bar Mills, Lim., The Ickles, Sheffield. (*Rolling Mills for bars.*)
Vickers-Armstrongs, Lim.,
Barrow-in-Furness. (*Steel castings and forgings.*)
Elswick Works, Elswick, Northumberland. (*Steel castings.*)
West Lothian Steel Foundry Co., Lim., Hardhill Works, Armadale, West Lothian. (*Small steel castings.*)
Whitehead Iron & Steel Co., Lim., Courtybella Works, Newport, Mon. (*Rolling Mills for steel strips, bars and sections.*)
Whitehead Thomas Bar and Strip Co., Lim., Redbourn Works, Scunthorpe, Lincs. (*Rolling Mills for steel bars and strips.*)
Williams (John), & Co. (Wishaw), 1922, Lim., Excelsior Iron & Steel Works, Craigneuk, Motherwell. (*Rolling mills for plates up to 8 mm. in thickness.*)
Wolsingham Steel Co., Lim., Wolsingham, co. Durham. (*Steel castings and forgings.*)

FIRMS IN COUNTRIES OTHER THAN GREAT BRITAIN AND IRELAND.

ALPHABETICALLY ARRANGED.

In the following list the name of each works is followed by the place of residence of the Surveyor giving attendance thereat.

A.S.S.A. Acciaierie di Susa Società Anonima, Torino, Italy; Head Office in Turin. (*Works* at Susa.) (*Small steel castings.*) (GENOA.)

Acciaierie Elettriche Pio Faggian, La Spezia, Italy. (*Small steel castings.*) (GENOA.)

Acciaieria e Ferriera del Caleotto, Società Anonima, Lecco riparto Castello, Italy. (*Steel ingots, bars and small sections.*) (GENOA.)

Acciaierie e Ferriere Lombarde Falck; *Head Office*, Milan. (*Works* at Milan, *weldless rolled or drawn steel tubes and hollow pillars.*) ("Unione" *Works* at Sesto S. Giovanni, *steel ingots, sections and bars.*) ("Concordia" *Works* at Sesto S. Giovanni, *Rolling mills for steel plates.*) (GENOA.)

Acciaieria e Tubificio di Brescia, Società Anonima, Brescia, Italy. (*Steel ingots, sections and bars, steel castings, weldless drawn or water gas welded tubular material.*) (GENOA.)

Aciéries de Gennevilliers, Gennevilliers, near Paris. (*Small steel castings.*) (PARIS.)

Aciéries de Haine St. Pierre et Lesquin, Société Anonyme, Haine St. Pierre, Belgium. (*Steel castings.*) (ANTWERP.)

Aciéries de Haine St. Pierre & Lesquin, Lesquin-lez-Lille (Nord), France. (*Steel castings.*) (DUNKIRK.)

Aciéries de Maromme (E. Breton), Maromme (Seine Inférieure), France. (*Steel castings.*) (ROUEN.)

Aciéries de Paris et d'Outreau, (Société Anonyme), Usine d'Outreau (Pas de Calais), France. (*Steel castings.*) (BOULOGNE.)

Aciéries et Ateliers de Grosse Forge, Maurice Dembiermont & Cie., Hautmont (Nord), France. (*Steel forgings.*) (ANTWERP.)

Aciéries Réunies de Burbach-Eich-Dudelange (Arbed). *Works* at Burbach (Saarbrucken-Burbach.) (*Ingots, blooms, billets and sections.*) *Works* at Hostenbach (Saarbrucken-Burbach.) (*Rolling mills for plates.*) *Works* at Dommeldange, Luxembourg. (*Steel ingots, forgings and castings.*) (METZ.)

Aciéries Sarroises Dingler, Karcher et Cie., Saarbrück. (*Steel castings.*) (METZ.)

Aktiebolaget Abjörn Anderson, Svedala, near Malmö, Sweden. (*Steel castings.*) (MALMÖ.)

Aktiebolaget Bofors, Bofors, Sweden. (*Melting Furnaces and Foundry* at Bofors.) (GOTHENBURG.)

Aktiebolaget Dalsbruk, Dalsbruk, Finland. (*Steel ingots, forgings, castings, bars and angles.*) (HELSINGFORS.)

Aktiebolaget Motala Verkstad, Motala Verkstad, Sweden. (*Melting Furnaces, Rolling Mills and Forge; also steel castings.*) (GOTHENBURG.)

Alan Wood Steel Company, Conshohocken and Ivy Rock, Pa., U.S.A. (*Blooms, billets and thin plates.*) (PHILADELPHIA.)

Algoma Steel Corporation, Lim., Sault St. Marie, Ontario, Canada. (*Steel billets, bars and angles.*) (TORONTO.)

Allegheny Steel Co., Brackenridge, Pa., U.S.A. (*Also steel castings.*) (PITTSBURGH.)

American Bridge Co., Pencoyd Iron Works, Pencoyd, Philadelphia, Pa., U.S.A. (*Sections, angles and bars.*) (PHILADELPHIA.)

American Rolling Mill Co., Middletown, O., U.S.A. (*Steel castings and forgings.*) (CLEVELAND, O.)

American Steel Foundries, Indiana Harbor, Ind., U.S.A. (*Steel castings.*) (CLEVELAND, O.)

Andrews Steel Co., Newport, Kentucky, U.S.A. (*Ingots, blooms, billets and slabs.*) (CLEVELAND, O.)

Asano Kokura Steel Co., Lim., Konomimachi, Kokura, Japan. (*Ingots.*) (NAGASAKI.)

Atlantic Steel Castings Co., Chester, Pa., U.S.A. (*Steel castings.*) (PHILADELPHIA.)

Atlas Steel Casting Co., Buffalo, N.Y., U.S.A. (*Steel castings.*) (CLEVELAND, O.)

August Thyssen-Hütte Aktiengesellschaft, Duisburg-Hamborn, Werk Hütte Ruhrort-Meiderich, Duisburg-Meiderich, Germany. (*Bars and sections only.*) (DÜSSELDORF.)

August Thyssen-Hütte Aktiengesellschaft, Duisburg-Hamborn, Werk Niederrheinische Hütte, Duisburg, Germany. (DÜSSELDORF.)

August Thyssen-Hütte Aktiengesellschaft, Duisburg-Hamborn, Werk Thyssen-Hütte, Duisburg-Hamborn, Germany. (*Bars and sections only.*) (DÜSSELDORF.)

Australian Alloy Steel, Lim., Alexandria, Sydney, N.S.W. (*Steel castings.*) (SYDNEY, N.S.W.)

Australian Iron & Steel, Lim., Port Kembla, N.S.W. (*Steel plates, bars and sections.*) (SYDNEY, N.S.W.)

Avesta Jernverks Aktiebolag, Avesta, Sweden. (*Steel plates, sections, and high pressure air receivers.*) (STOCKHOLM.)

Banska a Hutni Spolecnost (Berg- & Huttenwerks-Gesellschaft), Praha, II. (*Works* at Trinec. *Steel ingots, bars and sections.*) (*Works* at Karlova Hut. *Rolling Mills for plates.*) (VIENNA.)

Bergische Stahl-Industrie Kommanditgesellschaft, Remscheid, Germany. (*Steel ingots and castings.*) (DÜSSELDORF.)

Bethlehem Steel Co.,

Bethlehem, Pa., U.S.A. (*Steel ingots, bars and sections.*) (PHILADELPHIA.)

Buffalo, N.Y., U.S.A. (CLEVELAND, O.)

Cambria Works, Johnstown, Pa., U.S.A. (PITTSBURGH.)

Lebanon, Pa., U.S.A. (*Rolling Mills for bars.*) (PHILADELPHIA.)

Los Angeles, Cal., U.S.A. (*Round bars.*) (LOS ANGELES.)

Seattle, Wash., U.S.A. (*Sections and bars.*) (SEATTLE).

South San Franciso, Cal., U.S.A. (*Steel ingots, small sections and bars.*) (SAN FRANCISCO).

Sparrow's Point, Md., U.S.A. (BALTIMORE.)

Steelton, Pa., U.S.A. (*Steel forgings.*) (PHILADELPHIA.)

Björneborgs Jernverks Aktiebolag, Vermlands Björneborg, Sweden. (*Melting Furnaces and Forge.*) (GOTHENBURG.)

Blohm & Voss, Hamburg, Germany. (*Steel castings.*) (HAMBURG.)

Bochumer Verein für Gussstahlfabrikation Atkiengesellschaft, Bochum, Werk Bochum, Germany. (*Forgings, steel castings, rolled bars and weldless tubes.*) (DÜSSELDORF.)

Böhler, Gebr., & Co., Akt. Ges., Vienna. (*Works* at Kapfenberg, Styria, Austria.) (*Steel castings.*) (VIENNA.)

Bonney-Floyd Co., Columbus, O., U.S.A. (*Steel castings.*) (CLEVELAND, O.)

Bradford & Kendall, Lim., Alexandria, Sydney, N.S.W. (*Steel castings.*) (SYDNEY, N.S.W.)

Broken Hill Proprietary Co., Lim., Iron and Steel Works, Newcastle, N.S.W. (*Steel plates, bars, sections and castings.*) (NEWCASTLE, N.S.W.)

Buhl Malleable Co., Detroit, Mich., U.S.A. (*Steel castings.*) (CLEVELAND, O.)

Bultfabriks Aktiebolaget, Hallstahammar, Sweden. (*Steel castings.*) (STOCKHOLM.)

Burmeister & Wain's Maskin-og Skibsbyggeri, Aktieselskabet, Copenhagen. (*Steel ingots, forgings and castings.*) (COPENHAGEN.)

Canada Foundries & Forgings, Lim., Welland, Ontario. (*Steel forgings.*) (TORONTO.)

Canadian Car & Foundry, Steel Foundry Division, Longue Pointe, Montreal. (*Steel castings.*) (MONTREAL.)

Canadian Tube & Steel Products, Lim., 5765, Hamilton Street, Montreal, P.Q. (*Steel angles, bars and rivets.*) (MONTREAL.)

Cantieri del Tirreno, Società Anonima, Stabilimento alle Grazie, Genoa. (*Steel forgings*). (GENOA.)

Canton Steel Foundry Co., Canton, O., U.S.A. (*Steel castings and ingots.*) (CLEVELAND, O.)

Carnegie-Illinois Steel Corporation, Chicago, Ill., U.S.A. (CLEVELAND, O.)

Carnegie-Illinois Steel Corporation, Pittsburgh, Pa., U.S.A. (PITTSBURGH.)

Central Iron & Steel Co., Harrisburg, Pa., U.S.A. (*Rolling Mills.*) (PHILADELPHIA.)

Ceskomoravska - Kolben - Danek, Lim., Prague - Vysocany. (*Steel castings.*) (PRAGUE.)

Cleveland Steel Casting Co., Cleveland, O., U.S.A. (*Steel castings.*) (CLEVELAND, O.)

Cockatoo Docks & Engineering Co., Lim., Cockatoo, Sydney, N.S.W. (*Steel castings.*) (SYDNEY, N.S.W.)

Colorado (The) Fuel & Iron Co., Minnequa Works, Pueblo, Colo. (*Bars and small sections.*) (CLEVELAND, O.)

Columbia Steel Company, Pittsburgh, Cal., U.S.A. (*Steel castings.*) (SAN FRANCISCO.)

Commonwealth Steel Co., Lim., Waratah, Newcastle, N.S.W. (*Steel castings and forgings.*) (NEWCASTLE, N.S.W.)

Compagnie de Fives Lille, Société Anonyme, Fives Lille (Nord), France. (*Steel ingots, castings and forgings.*) (DUNKIRK.)

Compagnie des Forges de Chatillon, Commentry et Neuves-Maisons, Isbergues (Pas de Calais), France. (*Steel blooms, bars and sections.*) (DUNKIRK.)

Compagnie des Forges et Aciéries de la Marine et d'Homécourt, Homécourt (Meurthe & Moselle), France. (METZ.)

Compagnie des Forges et Aciéries de la Marine et d'Homécourt, Le Boucau (Forges de l'Adour), (Basses-Pyrénées), France. (*Bars and sections.*) (BORDEAUX.)

Compagnie des Forges et Aciéries de la Marine et d'Homécourt, St. Chamond (Loire), France. (ST. ETIENNE.)

Compagnie Générale des Aciers, Société Anonyme, Thy-le-Chateau, Belgium. (*Steel castings.*) (ANTWERP.)

Compañia Anonima Basconia, Bilbao, Spain. (BILBAO.)

Compañia Fabrica de Trubia, Trubia Asturias, Spain. (*Steel castings and forgings.*) (BILBAO.)

Compañia Siderurgica del Mediterraneo, Sagunto, Spain. (*Steel ingots, bars and sections.*) (VALENCIA.)

Crucible Steel Company of America, Park Works, Pittsburgh, Pa., U.S.A. (PITTSBURGH.)

Cumming (J. W.) Manufacturing Co., Lim., New Glasgow, Nova Scotia. (*Small steel castings.*) (HALIFAX, N.S.)

Detroit Steel Casting Co., Detroit, Mich., U.S.A. (*Steel castings.*) (CLEVELAND, O.)

Deutsche Babcock & Wilcox Dampfkessel-Werke Actien-Gesellschaft, Oberhausen, Germany. (*Steel castings.*) (DÜSSELDORF.)

Deutsche Edelstahlwerke A.G., Krefeld.

Krefelder Stahlwerk, Krefeld. (*Steel ingots and forgings.*)

Bergische Stahlindustrie, Remscheid. (*Steel forgings.*) (DÜSSELDORF.)

Deutsche Eisenwerke Aktiengesellschaft, Mülheim-Ruhr, Werk Friedrich Wilhelms - Hütte, Mülheim - Ruhr, Germany. (*Steel castings.*) (DÜSSELDORF.)

Deutsche Industrie Werke Aktiengesellschaft, Berlin-Spandau, Germany. (*Steel ingots, bars, sections and forgings.*) (STETTIN.)

Deutsche Röhrenwerke Aktiengesellschaft, Düsseldorf, Werk Dinslaken, Niederrhein, Germany. (*Weldless tubes, hollow pillars and masts.*) (DÜSSELDORF.)

Deutsche Röhrenwerke Aktiengesellschaft, Düsseldorf, Werk Düsseldorf, Germany. (DÜSSELDORF.)

Deutsche Röhrenwerke Aktiengesellschaft, Düsseldorf, Werk Mülheim-Ruhr, Germany. (*Steel plates, seamless and lapwelded tubes.*) (DÜSSELDORF.)

Deutsche Schiff und Maschinenbau Aktiengesellschaft, Werk Act. Ges. "Weser," Bremen, Germany. (*Small steel castings.*) (BREMEN.)

Deutsche Werke A. G., Kiel, Germany. (*Steel castings.*) (HAMBURG.)

Dodge Steel Company, Tacony, Philadelphia, Pa., U.S.A. (*Small steel castings.*) (PHILADELPHIA.)

Dominion Foundries & Steel Lim., Hamilton, Ontario. (*Steel ingots, plates and castings.*) (TORONTO.)

Dominion Steel & Coal Corporation Lim., Sydney, Nova Scotia. (*Steel ingots, billets, plates and sections.*) (HALIFAX, N.S.)

Dortmund-Hoerder Hüttenverein Aktiengesellschaft, Dortmund, Werk Dortmunder Union, Dortmund, Germany. (*Also steel castings.*) (DORTMUND.)

Dortmund-Hoerder Hüttenverein Aktiengesellschaft, Dortmund, Werk Hoerder Verein, Dortmund - Hoerde, Germany. (DORTMUND.)

Drammens Jernstoberi A/S., Drammen, Norway. (*Small steel castings.*) (OSLO.)

Eisen-und Hüttenwerke Aktiengesellschaft, Bochum, Germany. (*Steel forgings and castings.*) (DUSSELDORF.)

Erie Forge Co., Erie, Pa., U.S.A. (*Steel ingots, forgings and castings.*) (CLEVELAND, O.)

Etablissements J. J. Carnaud & Forges de Basse-Indre, Basse-Indre, Loire-Inférieure. (*Also steel castings.*) (NANTES.)

Fabbrica Italiana Tubi, Società Anonima, Sestri Levante, Italy. (*Steel ingots, billets and weldless rolled and drawn steel tubes.*) (GENOA.)

Fagersta Bruks Aktiebolag, Fagersta, Sweden (Brukskoncernen.)

Works at Fagersta. (*Steel blooms and billets.*)

Works at Forsbacka. (*Steel blooms, billets, tubes and forged and rolled bars.*) (STOCKHOLM.)

Falk Corporation, Milwaukee, Wis., U.S.A. (*Steel castings.*) (CLEVELAND, O.)

Finkl (A.) & Sons Company, Chicago, Ill., U.S.A. (*Steel forgings.*) (CLEVELAND, O.)

Fonderia Milanese di Acciaio Vanzetti, Milan. (*Steel castings.*) (GENOA.)

Fonderies & Aciéries de Provence, Marseilles. (*Steel castings.*) (MARSEILLES.)

Fonderies, Forges et Aciéries de St. Etienne, St. Etienne, France. (ST. ETIENNE.)

Forged Steel Wheel Co., Butler, Pa., U.S.A. (PITTSBURGH.)

Forges de la Loire et du Midi (Messrs. Marrel Frères), Rive de Gier, France. (ST. ETIENNE.)

Forges & Aciéries du Nord et de l'Est (France), Usines Metallurgiques de la Basse Loire, Trignac, near St. Nazaire. (NANTES.)

Forges et Ateliers de Constructions Electriques de Jeumont, Jeumont (Nord), France. (*Steel castings.*) (ANTWERP.)

Fratelli Bruzzo-Ferriera di Bolzaneto, Genova-Bolzaneto, Italy. (*Steel plates up to 25 mm. thickness; also sections and bars.*) (GENOA.)

Fratelli Ferreri di Ferreri Nicola, Turin, Italy. (*Small steel forgings.*) (GENOA.)

Fundiciones Escorsa S.A., Pi y Margall, 2- Hospitalet de Llobregat, Barcelona, Spain. (*Steel castings.*) (BARCELONA.)

Ganz & Co., Akt. Ges., Budapest. (*Steel castings and forgings.*) (VIENNA.)

Gebr. Böhler & Co., A.G., Stahlwerk Düsseldorf, Düsseldorf-Oberkassel, Germany. (*Ingots for steel forgings.*) (DÜSSELDORF.)

Geisweider Eisenwerke Act. Ges., Geisweid (Kreis Siegen), Germany. (*Rolling Mills.*) (DÜSSELDORF.)

General Metals Corporation (Best Plant Division), Oakland, Cal., U.S.A. (*Steel castings.*) (SAN FRANCISCO.)

General Steel Castings Corporation, Eddystone, Pa., U.S.A. (*Steel castings.*) (PHILADELPHIA.)

Gomei Kaisha Miki Cast Steel Works, Lim., Osaka, Japan. (*Small steel castings.*) (KOBE.)

Gould-Coupler Co., Depew, N.Y., U.S.A. (*Steel ingots.*) (CLEVELAND, O.)

Grandi Fucine Italiane-Gio. Fossati & Co., Società Anonima, Genoa-Sestri, Italy. (*Steel forgings.*) (GENOA).

Gruson (Otto) & Co., Eisen und Stahlwerk, Magdeburg-Buckau, Germany. (*Steel castings.*) (STETTIN.)

Gulf States Steel Co., Alabama City, Ala., U.S.A. (MOBILE, ALA.)

Gussstahlwerk Wittmann Aktiengesellschaft, Haspe, near Hagen, Westphalia, Germany. (*Steel castings.*) (DORTMUND.)

Gussstahlwerk Wolgast Betriebs-Gesellschaft m.b.H., Wolgast, Germany. (*Small steel castings.*) (STETTIN.)

Gutehoffnungshütte Oberhausen Aktiengesellschaft, Abteilung Düsseldorf, Düsseldorf-Grafenberg, Germany. (*Steel castings.*) (DÜSSELDORF.)

Gutehoffnungshütte Oberhausen Aktiengesellschaft, Oberhausen, Rheinland, Germany. (DÜSSELDORF.)

Hahn (Albert), Röhrenwalzwerke, Novy Bohumin, Czecho-Slovakia. (*Steel ingots, bars and sections.*) (VIENNA.)

Hahnsche Werke Act. Ges., Grossenbaum, near Duisburg, Germany. (*Broad flats and ingots.*) (DÜSSELDORF.)

Hakodate Dock Co., Lim., Hakodate, Japan. (*Small steel forgings and castings.*) (HAKODATE.)

Hauts-Fourneaux, Fonderies, Forges & Laminoirs de Meurthe & Moselle (Mr. Fould-Dupont), Usines de Pompey, France. (METZ.)

Hoesch-Köln Neuessen Aktiengesellschaft für Bergbau und Hüttenbetrieb, Dortmund, Germany. (*Rolling Mills.*) (DORTMUND.)

Holtzer, Jacob, & Co., Aciéries d'Unieux, Unieux (Loire), France. (*Steel forgings and castings.*) (ST. ETIENNE.)

Hong Kong & Whampoa Dock Co., Lim., Kowloon Docks, Hong Kong. (*Steel castings.*) (HONG KONG.)

Hubbard Steel Foundry Co., East Chicago, Ind., U.S.A. (*Steel castings.*) (CLEVELAND, O.)

Huntington Steel Co., Huntington, Ind., U.S.A. (*Steel castings.*) (CLEVELAND, O.)

Huta Pokoj Sp. A., Katowice.

Works "Baildonhutte" at Katowice, G/S.

Works "Huta Pokoj" at Nowy Bytom, G/S. (VIENNA.)

Hüttenwerke Siegerland Aktiengesellschaft Siegen, Werk Charlottenhütte, Niederschelden (Sieg), Germany. (*Steel plates and ingots.*) (DÜSSELDORF.)

Ignaz Storek, Brünn, Czecho-Slovakia. (*Steel castings.*) (PRAGUE.)

"Ilva" Alti Forni e Acciaierie d'Italia; *Head Office*, Genoa. (GENOA.)

Stabilimento di Genova-Sestri. (*Sections, bars and plates.*)

Stabilimento di Genova-Bolzaneto. (*Sections and bars.*)

Stabilimento di Genova-Voltri. (*Small sections, bars and rivets.*)

Stabilimento di Savona. (*Sections, bars and plates.*)

Stabilimento di Lovere. (*Sections, bars, castings and forgings.*)

Stabilimento di Novi Ligure. (*Rolling Mills for steel plates up to 15 mm. in thickness, also sections and bars.*) (GENOA.)

Stabilimento di Bagnoli, Bagnoli. (*Steel ingots, sections and bars.*) (NAPLES.)

Stabilimento di Torre Annunziata Centrale, Torre Annunziata Centrale. (*Steel ingots, sections and bars.*) (NAPLES.)

Stabilimento di Marghera. (*Steel castings; also Rolling Mills for small steel sections and bars.*) (TRIESTE.)

Industrial Steel Castings Co., Toledo, O., U.S.A. (*Steel castings.*) (CLEVELAND, O.)

Inland Steel Co. (*Steel Works* at Indiana Harbor, Ind., U.S.A., and *Rolling Mills* at Chicago Heights, Chicago, Ill., U.S.A.) (CLEVELAND, O.)

Japan Steel Works, Lim., Hiroshima Works, Hiroshima, Japan. (*Steel ingots, forgings and castings.*) (KOBE.)

Japan Steel Works, Lim. (The), Muroran, Japan. (*Steel ingots, forgings and castings.*) (HAKODATE.)

Joliette Steel, Lim., Joliette, Quebec. (*Steel castings.*) (MONTREAL.)

Jones & Laughlin Steel Corporation, Pittsburgh, Pa., U.S.A. (PITTSBURGH.)

Kaneko Steel Foundry, Minato-ku, Osaka, Japan. (*Steel castings.*) (KOBE.)

Katowicka Sp. A. dla Gornictwa i Hutnictwa, Katowice.

Works "Huta Batorego" at Hajduki Wielkie, G/S. (*Also steel castings and weldless rolled or drawn steel hollow pillars and davits.*)

Works "Huta Falva" at Swientochlowice, G/S.

Works "Krolewska Huta" at Krolewska Huta, G/S. (*Steel plates, angles, bars and forgings.*)

Works "Huta Laura" at Siemianowice, G/S. (*Steel plates, angles, bars and weldless tubes.*) (VIENNA.)

Kawasaki Dockyard Co., Lim. (Fukiai Works), Kobe, Japan. (KOBE.)

Kawasaki Sharyo Kabushiki Kaisha, Shiri-ike-mura, Hiogo, Japan. (*Steel castings and forgings.*) (KOBE.)

Klöckner-Werke A. G., Abteilung Georgs-Marien-Werke, Osnabrück, Germany. (*Steel ingots, sections, forgings and castings.*) (DÜSSELDORF.)

Klöckner-Werke A. G., Abteilung Hasper Eisen- und Stahlwerk, Haspe, Westphalia, Germany. (*Steel ingots, plates, bars and sections.*) (DORTMUND).

Klöckner-Werke A. G., Abteilung Mannstaedtwerke, Troisdorf, near Cologne, Germany. (*Rolling Mills for sections.*) (DÜSSELDORF.)

Kobe Steel Works, Lim., Kobe, Japan. (*Steel castings, forgings, and plain and angle bars of small section.*) (KOBE.)

Kockums Jernverk, Kallinge, Sweden. (*Steel castings.*) (HELSINGBORG.)

Kohlswa Jernverks Aktiebolag. (*Melting Furnaces, Foundry and Forge* at Kohlswa, Sweden.) (STOCKHOLM.)

Königlich Ungarische Staatliche Eisen-, Stahl- und Maschinenfabriken, Budapest. (*Works* at Diösgyör, Hungary.) (*Steel castings, forgings, plates and sections.*) (VIENNA.)

Kurimoto Iron Works, Lim., 77, Shinsumiya-cho, Taisho-ku, Osaka. (*Steel castings.*) (KOBE.)

Kranjska Industrjska Druzba, Jesenice-Fuzine, Yugoslavia. (TRIESTE.)

Krautheim (G.) Aktiengesellschaft, Chemnitz-Borna, Germany. (*Steel castings.*) (STETTIN.)

Krupp, Fried., Act. Ges., Essen, Germany. (*Steel plates, forgings and castings.*) (DÜSSELDORF.)

Krupp, Fried., Act. Ges., Grusonwerk, Magdeburg-Buckau, Germany. (*Steel castings.*) (STETTIN.)

Krupp, Fried., Act. Ges., Friedrich Alfred Hütte, Rheinhausen—Friemersheim, Germany. (*Bars and sections only.*) (DÜSSELDORF.)

La Maquinista Terrestre y Maritima, S.A., Barcelona. (*Steel castings.*) (BARCELONA.)

Lebanon Steel Foundry, Lebanon, Pa., U.S.A. (*Small steel castings.*) (PHILADELPHIA.)

Limited Co., formerly the Skoda-Works, Pilsen. (*Steel castings and forgings.*) (PRAGUE.)

Branch Works at Hradek, near Rokycany. (*Rolling Mills for bars and sections.*) (PRAGUE.)

Lukens Steel Company, Coatesville, Pa., U.S.A. (PHILADELPHIA.)

Machine Fabriek Yzer-Staal & Metaal Gieterij (v/h Bakker & Co.), Ridderkerk. (*Steel castings.*) (ROTTERDAM.)

Mannesmannröhrenwerke, Abteilung Grillo Funke, Gelsenkirchen Schalke, Westphalia, Germany. (DÜSSELDORF.)

Mannesmannröhren-Werke, Abteilung Heinrich Bierwes-Hütte, Duisburg-Huckingen, Germany. (*Steel Works and Rolling Mills for plates, bars and sections.*) (DORTMUND.)

Mannesmannröhrenwerke Aktiengesellschaft, Svinov-Vitkovice, Czecho-Slovakia. (*Weldless steel tubes.*) (VIENNA.)

Mannesmannröhrenwerke, Düsseldorf and Remscheid, Germany. (*Weldless rolled or drawn steel hollow pillars and davits.*) (DÜSSELDORF.)

Mannesmannröhrenwerke, Komotau, Czecho-Slovakia. (*Weldless steel tubes.*) (PRAGUE.)

Maschinenfabrik Augsburg-Nürnberg A.G., Augsburg, Germany. (*Steel forgings.*) (AUGSBURG.)

Matsuo Chuko Kabushiki Kaisha, Osaka, Japan. (*Steel castings.*) (KOBE.)

Maynard Electric Steel Castings Co., Milwaukee, Wisconsin, U.S.A. (*Steel castings.*) (CLEVELAND, O.)

Mesta Machine Co., West Homestead, Pa., U.S.A. (*Steel ingots, castings and forgings.*) (PITTSBURGH.)

Michigan Steel Casting Co., Detroit, Mich., U.S.A. (*Small castings.*) (CLEVELAND, O.)

Midvale Company (The), Nicetown, Philadelphia, Pa., U.S.A. (*Steel forgings.*) (PHILADELPHIA.)

Mitsu Bishi Seitetsu Kabushiki Kaisha, Kenjiho, Korea. (KOBE.)

Mitsubishi Jukogyo Kabushiki Kaisha.

Kobe Works. (*Steel castings.*) (KOBE.)

Nagasaki Works. (*Steel ingots, blooms, forgings, castings and plates.*) (NAGASAKI.)

Yokohama Dock Works. (*Steel ingots, blooms, small forgings and castings.*) (YOKOHAMA.)

Mitsui Bussan Kaisha, Tama Yard, Tama, Japan. (*Steel castings.*) (KOBE.)

Mitteldeutsche Stahlwerke Akt. Ges., Lauchhammerwerk Gröditz, Gröditz, Germany. (*Steel castings.*) (STETTIN.)

Mitteldeutsche Stahlwerke Akt. Ges., Lauchhammerwerk Riesa, Riesa, Germany. (*Rolling Mills for bars; seamless steel tubes.*) (STETTIN.)

Mitteldeutsche Stahlwerke Aktiengesellschaft, Stahl-und Walzwerk Weber, Brandenburg (Havel), Germany. (*Steel plates and ingots.*) (STETTIN.)

Modrzejowskie Zaklady Gorniczo-Hutnicze, S.A., Sosnowice.

Works at Huta Katarzyna. (*Steel Ingots.*)

Works at Huta Milowice. (*Rolling Mills for blooms and round bars.*) (VIENNA.)

Monarch Steel Castings Co., Detroit, Mich., U.S.A. (*Steel castings.*) (CLEVELAND, O.)

Muto Denki Seikosho (Muto Electric Steel Works), Osaka, Japan. (*Steel castings.*) (KOBE.)

N.V. Machinefabriek G. Dikkers & Co., Hengelo, Holland. (*Small steel castings.*) (AMSTERDAM.)

Nakayama Steel Works, Lim., Osaka, Japan. (*Steel ingots and plates.*) (KOBE.)

National Enameling & Stamping Co., Granite City, Ill., U.S.A. (CLEVELAND, O.)

National Erie Co., Erie, Pa., U.S.A. (*Steel castings.*) (CLEVELAND, O.)

National Malleable and Steel Castings Co., Sharon, Pa., U.S.A. (*Steel ingots*) (PITTSBURGH); and Melrose Park, Chicago, Ill., U.S.A. (*Steel ingots.*) (CLEVELAND, O.)

National Steel Foundries Co., Milwaukee, Wis., U.S.A. (*Steel castings.*) (CLEVELAND, O.)

National Tube Co., Lorain, O., U.S.A. (*Blooms, billets and plates.*) (CLEVELAND, O.)

Nederlandsche Staalfabrieken (v/h J. M. de Muinck Keizer), Utrecht, Holland. (*Steel ingots, blooms, billets and castings.*) (AMSTERDAM.)

Neunkircher Eisenwerke, A. G., Neunkirchen. (Saar.) (*Steel bars and sections, also steel rivet bars.*) (METZ.)

Newport News Shipbuilding & Dry Dock Co., Newport News, Va., U.S.A. (*Steel castings and forgings.*) (NEWPORT NEWS.)

Niigata Tekkosho, Niigata, Japan. (*Steel castings.*) (KOBE.)

Nippon Chuzo Kabushiki Kaisha, 2 chome, Suehiro-cho, Tsurumi-ku, Yokohama, Japan. (*Steel castings.*) (YOKOHAMA.)

Nippon Kokan Kabushiki Kaisha, Kawasaki, Japan. (*Steel tubes, bars and sections.*) (YOKOHAMA.)

Nippon Seitetsu Kabushiki Kaisha, Osaka Seitetsu-sho, Osaka, Japan. (*Small steel angles and bars.*) (KOBE.)

Nippon Seitetsu Kabushiki Kaisha, Yawata Seitetsu-sho, Yawata, Japan. (NAGASAKI.)

Nippon Steel Foundry, Lim., Osaka, Japan. (*Steel castings.*) (KOBE.)

Nordische Stahlwerke, Bach & Co., Kommanditgesellschaft, Neumünster, Germany. (*Small steel castings.*) (HAMBURG.)

Northwestern Steel & Iron Corporation, Minneapolis, Minn., U.S.A. (*Steel castings.*) (CLEVELAND, O.)

Nova Scotia Steel & Coal Co., Lim. (*Rolling Mills* at New Glasgow, N.S.) (*Forgings, sections and bars.*) (HALIFAX, N.S.)

Oesterreichisch-Alpine Montangesellschaft, Vienna.

Works at Donawitz, Styria. (*Plates and sections.*)

Works at Kindberg, Styria. (*Rolling Mills for small sections.*) (VIENNA.)

Officine Metallurgiche Bergamasche Società Anonima, Bergamo, Italy. (*Small steel forgings.*) (GENOA.)

Ohio Steel Foundry Co., Lima, O., U.S.A. (CLEVELAND, O.)

Oliver Iron & Steel Co., Pittsburgh, Pa., U.S.A. (*Rolling Mills for bars.*) (PITTSBURGH.)

Olympic Steel Works, Seattle, Wash., U.S.A. (*Steel castings.*) (SEATTLE, WASH.)

Osaka Chain and Machinery Works, Lim., Osaka, Japan. (*Small steel castings.*) (KOBE.)

Osaka Iron Works, Lim., Sakurajima Works, Osaka, Japan. (*Steel castings and forgings.*) (KOBE.)

Oshima Steel Works, Oshima, Tokio, Japan. (*Steel castings and forgings.*) (YOKOHAMA.)

Otis Elevator Co., Buffalo, N.Y., U.S.A. (*Steel castings.*) (CLEVELAND, O.)

Otis Steel Co. (The), Cleveland, O., U.S.A. (CLEVELAND, O.)

Pelton Steel Co., Milwaukee, Wis., U.S.A. (*Steel castings.*) (CLEVELAND, O.)

Penn Steel Castings Corporation, Chester, Pa., U.S.A. (*Steel castings.*) (PHILADELPHIA.)

Pennsylvania Forge Corporation, Tacony, Philadelphia, Pa., U.S.A. (*Steel ingots and forgings.*) (PHILADELPHIA.)

Phœnix Iron Company (The), Phœnixville, Pa., U.S.A. (*Sections and bars.*) (PHILADELPHIA.)

Pittsburgh Crucible Steel Co., Midland, Pa., U.S.A. (PITTSBURGH.)

Pittsburgh Steel Foundry, Glassport, Pa., U.S.A. (*Steel castings and ingots.*) (PITTSBURGH.)

Poldi Steel Works, Kladno, near Prague. (PRAGUE.)

Prazska zelezarska spolecnost, Kladno, near Prague. (PRAGUE.)

Press & Walzwerk Akt. Ges., Abteilung Oberbilker Stahlwerk, Düsseldorf-Oberbilk, Germany. (*Steel ingots and forgings.*) (DÜSSELDORF.)

Puget Sound Steel Works, Tacoma, Wash., U.S.A. (*Steel castings.*) (SEATTLE.)

Railway Steel Spring Co., Chicago Heights, Ill., U.S.A. (*Steel ingots.*) (CLEVELAND, O.)

Raufoss Ammunisjonsfabrikker, Raufoss, Norway. (*Steel castings.*) (OSLO.)

Republic Steel Corporation, Cleveland, O., U.S.A.

- Buffalo Plant, Buffalo, N.Y., U.S.A. (CLEVELAND, O.)
- Central Alloy District, Massillon Plant, Massillon, O., U.S.A. (CLEVELAND, O.)
- Chicago Plant, Chicago, Ill., U.S.A. (CLEVELAND, O.) (*Steel Works* at 118th Street, Chicago, and *Rolling Mills* at East Chicago, Ind.) (*Steel angles and bars.*)
- Cleveland District, Cleveland, O., U.S.A. (CLEVELAND, O.)
  - Corrigan McKinney Plant. (*Steel ingots, blooms and billets.*)
  - Upson Nut Plant. (*Round and square steel bars.*)
- Youngstown Plant, Youngstown, O., U.S.A. (PITTSBURGH.)

Rheinmetall-Borsig Aktiengesellschaft, Werk Düsseldorf, Germany. (*Steel ingots and forgings; and weldless steel tubes.*) (DÜSSELDORF.)

Rheinmetall-Borsig Aktiengesellschaft, Werk Borsig, Berlin-Tegel. (*Steel ingots, forgings and castings.*) (STETTIN.)

Rimamurany Salgo-Tarjaner Eisenwerke Act. Ges., Budapest. (*Steel Works* in Ozd, Hungary.) (VIENNA.)

Rochling'sche Eisen-und Stahlwerke, Volklingen-Saar. (*Steel ingots, billets, bars, forgings and castings.*) (METZ.)

Roxbury Steel Casting Co., Boston, Mass., U.S.A. (*Steel castings.*) (BOSTON.)

Ruhrstahl Aktiengesellschaft, Annener Gussstahlwerk, Witten-Annen, near Dortmund, Westphalia, Germany. (*Steel castings.*) (DORTMUND.)

Ruhrstahl Aktiengesellschaft, Gelsenkirchener Gussstahlwerk, Gelsenkirchen, Germany. (*Steel castings.*) (DORTMUND.)

Ruhrstahl Aktiengesellschaft, Gussstahlwerk Witten, Witten, Germany. (*Steel sections, bars and forgings.*) (DORTMUND.)

Ruhrstahl Aktiengesellschaft, Henrichshütte, Hattingen-Ruhr, Germany. (*Steel ingots, forgings, castings and plates.*) (DORTMUND.)

Ruhrstahl Aktiengesellschaft, Stahlwerk Krieger, Düsseldorf, Germany. (*Steel castings.*) (DÜSSELDORF.)

Ruwolt (Charles) Proprietary, Lim., Richmond, Melbourne. (*Steel castings.*) (MELBOURNE.)

Sandvikens Jernverks Aktiebolag, Sandviken, Sweden. (*Steel ingots, forgings and steel tubes.*) (STOCKHOLM.)

Schäffer & Budenberg G.m.b.H., Magdeburg-Buckau, Germany. (*Small steel castings.*) (STETTIN.)

Schichau, F., Elbing, West Prussia, Germany. (*Steel ingots, forgings and castings.*) (GDYNIA.)

Schneider & Co., Creusot. (ST. ETIENNE.)

Schoeller-Bleckmann Stahlwerke A.G., Vienna. (*Works* at Hoenigsberg, Styria (*Steel bars.*) *Works* at Ternitz, Nieder-Oesterreich. (*Steel bars and castings; also seamless steel tubes.*) (VIENNA.)

Scullin Steel Co., St. Louis, Mo., U.S.A. (*Steel castings.*) (CLEVELAND, O.)

Sharon Steel Hoop Co., Youngstown, O., U.S.A. (*Steel melting plant* at Lowellville, O.; and *Rolling Mills at* Youngstown, O.) (PITTSBURGH.)

Skoda Works (*see* Limited Co.).

Smedjebackens Valsverks Aktiebolaget, Smedjebacken, Sweden. (*Steel sections and castings.*) (STOCKHOLM.)

Sociedad Altos Hornos de Vizcaya, Bilbao. (BILBAO.)

Sociedad Anonima Aceros de Elorrieta, Bilbao. (*Steel castings.*) (BILBAO.)

Sociedad Anonima Echevarria, Bilbao. (*Small sections and bars.*) (BILBAO.)

Sociedad Anonima Industrial Asturiana, Fabricas de Moreda y Gijon, Gijon. (*Rivet bars.*) (BILBAO.)

Sociedad Anonima Industrias Mecanicas, Barcelona, Spain. (*Steel castings.*) (BARCELONA.)

Sociedad Anonima Jose Maria Quijano, Forjas de Los Corrales de Buelna, Provincia de Santander, Spain. (*Steel bars.*) (BILBAO.)

Sociedad Anonima Talleres de Deusto, Deusto, Bilbao. (*Steel castings.*) (BILBAO.)

Sociedad Española de Construccion Naval, Reinosa, near Santander, Spain. (*Steel ingots, forgings, castings, plates, and sections.*) (BILBAO.)

Sociedad Metalurgica Duro-Felguera, La Felguera, Asturias, Spain. (BILBAO.)

Società Alti Forni e Acciaierie d'Italia, Porto Vecchio di Piombino, Italy. (*Steel ingots, blooms, sections and bars.*) (GENOA.)

Società Anonima Acciaierie Elettriche di Sesto San Giovanni, Sesto San Giovanni, Milan, Italy. (*Steel castings.*) (GENOA.)

Società Anonima FIAT.

- Sezione Ferriere, Piemontesi, Turin. (*Steel ingots, plates, sections, also seamless and welded tubes.*)
- Sezione Industrie Metallurgiche Acciaierie, Turin. (*Steel castings and forgings.*) (GENOA.)

Società Anonima Fonderie Officine di Gorizia, Gorizia, Italy. (*Small steel castings.*) (TRIESTE.)

Società Anonima Nazionale Cogne-Miniere, Alti Forni, Acciaierie (*Head Office*, Turin; *Works* at Aosta). (*Steel ingots, forgings, plates, sections and bars.*) (GENOA.)

Società Italiana Acciaierie Cornigliano (*Head Office and Works* at Genova-Cornigliano). (*Steel ingots, forgings, castings, plates and sections.*) (GENOA.)

Società Italiana Ernesto Breda, Sesto S. Giovanni, Milan, Italy. (*Steel ingots, sections, forgings, and steel castings.*) (GENOA.)

Società Nazionale delle Officine di Savigliano. (*Head Office*, Turin; *Works* at Savigliano.) (*Steel ingots, forgings and castings.*) (GENOA.)

Société Anonyme Baume et Marpent, Marpent (Nord), France. (*Steel castings.*) (ANTWERP.)

Société Anonyme d'Angleur-Athus. (ANTWERP.)

Works at Grivegnée.

Works at Tilleur-lez-Liége. (*Rolling Mills for bars and sections only.*)

Société Anonyme de Commentry-Fourchambault et Decazeville, Imphy (Nievre). (*Steel ingots, bars, sections, castings, and forgings.*) (ST. ETIENNE.)

Société Anonyme d'Escaut & Meuse, Anzin (Nord), France. (ANTWERP.)

Société Anonyme de la Fabrique de Fer de Charleroi, Charleroi, Belgium. (*Steel ingots and plates.*) (ANTWERP.)

Société Anonyme de la Fabrique de Fer de Maubeuge, Louvroil (Nord), France. (*Steel ingots and plates.*) (ANTWERP.)

Société Anonyme des Aciéries de la Meuse, Cheratte-lez-Liége, Belgium. (*Steel castings.*) (ANTWERP.)

Société Anonyme des Aciéries & Forges de Firminy, Firminy (Loire), France. (*Steel castings.*) (ST. ETIENNE.)

Société Anonyme des Aciéries ci-devant Georges Fischer, Schaffhouse, Switzerland. (*Steel castings.*) (WINTERTHUR.)

Société Anonyme des Aciéries Nantaises, Nantes. (*Steel castings.*) (NANTES.)

Société Anonyme des Aciéries Valère Mabille, Mariemont, Belgium. (*Small steel castings.*) (ANTWERP.)

Société Anonyme des Forges de Vireux-Molhain, Vireux-Molhain, Ardennes, France. (*Plates, bars, and sections.*) (ANTWERP.)

Société Anonyme des Forges et Aciéries de Dilling, Dillingen-Saar. (METZ.)

Société Anonyme des Forges et Aciéries de Huta-Bankowa, Dabrowa-Gornicza, G.S., Poland. (*Works* at Dabrowa, G.S.) (*Steel plates, sections, and castings.*) (VIENNA.)

Société Anonyme des Forges et Laminoirs de Baume, Haine St. Pierre, Belgium. (*Rolling Mills for bars and sections.*) (ANTWERP.)

Société Anonyme des Forges, Usines & Fonderies de Haine St. Pierre, Haine St. Pierre, Belgium. (*Steel castings.*) (ANTWERP.)

Société Anonyme des Hauts-Fourneaux de la Chiers, Longwy Bas, France. (*Rounds for rivets, stays and bolts.*) (METZ.)

Société Anonyme des Hauts-Fourneaux, Forges & Aciéries de Denain et D'Anzin, Denain (Nord), France. (*Steel plates, round bars, and steel castings.*) (ANTWERP.)

Société Anonyme des Laminoirs, Hauts-Fourneaux, Forges & Fonderies de la Providence, Hautmont (Nord), France. (ANTWERP.)

Société Anonyme des Usines de Fabrication de Tubes et de Forges de Sosnowice, Sosnowice, Poland. (*Seamless steel tubes.*) (VIENNA.)

Société Anonyme des Usines Gilson, La Croyère (Bois d'Haine), Belgium. (*Steel ingots, blooms, sections, rivet bars and forgings.*) (ANTWERP.)

Société Anonyme d'Ougrée-Marihaye, Ougrée, near Liége, Belgium. (ANTWERP.)

Société Anonyme John Cockerill, Seraing, Belgium. (ANTWERP.)

Société Anonyme La Brugeoise et Nicaise & Delcuve, St. Michel-lez-Bruges, Belgium. (*Steel ingots, forgings, and castings.*) (ANTWERP.)

Société Anonyme Usines & Aciéries Leonard-Giot, Marchienne-au-Pont, Belgium. (*Steel castings.*) (ANTWERP.)

Société des Aciéries de Longwy, Mont St. Martin (Meurthe & Moselle), France. (METZ.)

Société des Usines de Louis de Roll, Gerlafingen, Switzerland. (*Steel ingots, round bars, and forgings.*) (WINTERTHUR.)

Société Française de Constructions Mécaniques (Anciens Etablissements Cail), Denain (Nord), France. (*Steel ingots, blooms, bars, sheets, castings, and forgings.*) (ANTWERP.)

Société Métallurgique de Normandie, Mondeville (Calvados), France. (HAVRE.)

Société Métallurgique de Senelle-Maubeuge, Senelle, near Longwy, Meurthe et Moselle, Metz. (*Steel ingots, blooms, bars, and sections.*) (METZ.)

Spolka Akcyjna Wielkich Piecow i Zakladow, Ostrowieckich, Poland. (*Steel castings, forgings, sections and small plates.*) (GDYNIA.)

Stabilimenti di Dalmine, Società Anonima, Dalmine (Bergamo). (*Weldless rolled or drawn steel tubes, hollow pillars and davits, and iron and steel lap-welded tubes.*) (GENOA.)

Stahl und Walzwerk Hennigsdorf Aktiengesellschaft, Hennigsdorf, near Berlin. (*Steel castings and forgings.*) (STETTIN.)

Stahlwerk Mannheim Akt. Ges., Mannheim-Rheinau, Germany. (*Steel castings and forgings.*) (AUGSBURG.)

Stahlwerk Mark Wengern, Aktiengesellschaft, Wengern-Ruhr, Germany. (*Steel castings.*) (DORTMUND.)

Standard Steel Works Co., Burnham, Mifflin County, Pa., U.S.A. (*Steel castings and forgings.*) (PHILADELPHIA.)

Statne Zeleziarne a Oceliarne, Podbrezove, Czecho-Slovakia. (*Rolling Mills for plates and sections; also seamless steel tubes.*) (VIENNA.)

Stavanger Electro-Staalverk A.S., Stavanger, Norway. (*Steel castings.*) (OSLO.)

Steel & Tube Co. of America, Mark Plant, Indiana Harbor, Ind., U.S.A. (CLEVELAND, O.)

Steel Company of Australia, Brunswick, Melbourne. (*Steel castings.*) (MELBOURNE.)

Steel Company of Canada, Hamilton, Ontario. (*Works* at Hamilton.) (TORONTO.) (*Works* at Montreal.) (*Bars and angles.*) (MONTREAL.)

Sterling Steel Foundry Co., Braddock, Pa., U.S.A. (*Steel castings.*) (PITTSBURGH.)

Stora Kopparbergs Bergslags Aktiebolag, Falun, Sweden. (*Steel Works* at Domnarfvet.) (*Sections of all sizes and plates up to 30 mm. thick; steel castings.*) (STOCKHOLM.)

Strömmens Verksted, near Oslo. (*Steel castings.*) (OSLO.)

Strömsnäs Jernverks Aktiebolag, Degerfors, Sweden. (*Melting Furnaces and Rolling Mills.*) (GOTHENBURG.)

Strong Steel Foundry Co., Buffalo, N.Y., U.S.A. (*Steel castings.*) (CLEVELAND, O.)

Sucesora de Aceros Electricos S.A., Barcelona, Spain. (*Steel castings.*) (BARCELONA.)

Sulzer Frères, Société Anonyme, Winterthur, Switzerland. (*Steel castings.*) (WINTERTHUR.)

Sumitomo Metal Industries, Lim.

Steel Works, Osaka. (*Steel castings and forgings.*) (KOBE.)

Steel Tube Works, Amagasaki. (*Ingots, small bars and sections; also weldless steel tubes.*) (KOBE.)

Surahammars Bruks Aktiebolag, Surahammar, Sweden. (*Forge and Rolling Mills, also steel castings.*) (STOCKHOLM.)

Tata Iron & Steel Co., Lim., Jamshedpur, India. (*Steel plates, angles, and channels.*) (CALCUTTA.)

Tennessee Coal, Iron & Railroad Co., Birmingham, Ala., U.S.A. (*Steel Works* at Ensley, Ala., and *Rolling Mills, also forgings*, at Bessemer and Fairfield, Ala.) (MOBILE, ALA.)

"Terni" Società per l'Industria e l'Elettricità. (*Works* at Terni.) (*Steel ingots, forgings, castings and plates.*) (NAPLES.)

Thompson's Engineering & Pipe Co., Lim., Williamstown, Victoria. (*Steel castings.*) (MELBOURNE.)

Tokai Kogyo Kaisha, Lim., Wakamatsu, Japan. (*Rolling Mills for plates and angles.*) (NAGASAKI.)

Tokyo Kozai Kabushiki Kaisha. Tokyo Works (*Steel ingots, bars and sections*); Hirota Works (*Steel ingots*). (YOKOHAMA.)

Toledo Steel Casting Co., Toledo, O., U.S.A. (*Steel castings.*) (CLEVELAND, O.)

Tosi (Franco), Legnano, Italy. (*Steel forgings and castings.*) (GENOA.)

Travaux Métalliques de Boom, Société Co-opérative, Boom, Belgium. (*Steel castings.*) (ANTWERP.)

Tsurumi Seitetsu Zosen Kabushiki Kaisha, Tsurumi, Kojo, Japan. (*Rolling Mills for plates.*) (YOKOHAMA.)

Twin City Forge & Foundry Co., Stillwater, Minnesota, U.S.A. (*Steel castings.*) (CLEVELAND, O.)

Uddeholms Aktiebolag, Uddeholm, Sweden. Nykroppa, Sweden. (*Steel ingots, forgings and bars.*) (GOTHENBURG.) Storfors, Sweden. (*Weldless steel tubes.*) (STOCKHOLM.)

Union de Consommateurs de Produits Metallurgiques et Industriels, Usines d'Hagondange, Moselle. (*Steel blooms, billets, bars, and sections.*) (METZ.)

Union des Aciéries, Société Anonyme, Marcinelle, Charleroi, Belgium. (*Steel castings.*) (ANTWERP.)

Union Steel Casting Co., Pittsburgh, Pa., U.S.A. (*Steel castings.*) (PITTSBURGH.)

Uraga Dock Co., Lim., Uraga, Japan. (*Steel castings.*) (YOKOHAMA.)

Usines & Aciéries Allard, Société Anonyme, Mont-sur-Marchienne, near Charleroi, Belgium. (*Steel castings.*) (ANTWERP.)

Usines & Aciéries Allard, Société Anonyme, Turnhout, Belgium. (*Small steel castings.*) (ANTWERP.)

Usines Emile Henricot, Court St. Etienne, Belgium. (*Steel castings.*) (ANTWERP.)

Usines Gustave Boël (Aciéries de la Louvière), La Louvière, Belgium. (*Steel plates, sections, rivet bars and steel castings.*) (ANTWERP.)

Usines Métallurgiques du Hainaut, Couillet, Belgium. (*Steel forgings, castings, bars and sections.*) (ANTWERP.)

Uzinele de Fier si Domeniile din Resita, Societatea Anonima, Timisoara-Bucuresti. (BRAILA.)

Van Tongelsche Stahlwerke G.m.b.H., Güstrow i. M., Germany. (*Steel castings.*) (HAMBURG.)

Vancouver Engineering Works, Lim., Vancouver, B.C. (*Steel castings.*) (VANCOUVER, B.C.)

Varde Staalvaerk, Varde, Denmark. (*Steel ingots and castings.*) (COPENHAGEN.)

Vereinigte Oberschlesische Huttenwerke Aktiengesellschaft, Gleiwitz, O/S. *Works* "Herminenhütte" at Laband, O/S. (*Rolling Mills for small sections and bars.*) *Works* "Julienhütte" at Bobrek, O/S. (*Ingots, blooms and billets.*) *Works* "Stadtwerke Gleiwitz" at Gleiwitz, O/S. (*Steel ingots, blooms and forgings.*) *Works* "Stahlrohrenwerke" at Gleiwitz, O/S., Stadtwald. (*Seamless steel tubes.*) *Works* "Zawadzkiwerke" at Zawadzki, O/S. (*Rolling Mills for sections and bars.*) (VIENNA.)

Vitkovice Mines, Steel & Ironworks Corporation, Mor Ostrava, 10 (Witkowitzer Bergbau- & Eisenhütten-Gewerkschaft, Mahr. Ostrau, 10). *Works* at Vitkovice. (VIENNA.)

Washington Iron Works, Seattle, Wash., U.S.A. (*Steel castings.*) (SEATTLE.)

Weiss Manfred, Stahl-und Metallwerke Aktiengesellschaft, Budapest. (*Works* at Budapest—Czepel.) (*Steel ingots and seamless steel tubes.*) (VIENNA.)

Wellman-Seaver-Morgan Co., Cleveland, O., U.S.A. (*Steel castings.*) (CLEVELAND, O.)

Wendel, les Petits Fils de Fois de, Usine "Fenderie," Hayange, Moselle. (METZ.)

Western Crucible Steel Casting Co., Minneapolis, Minn., U.S.A. (*Steel castings.*) (CLEVELAND, O.)

Wheeling Mold & Foundry Co., Wheeling, W.Va., U.S.A. (*Steel castings.*) (PITTSBURGH.)

Wheeling Steel Corporation, La Belle Works, Steubenville, O., U.S.A. (PITTSBURGH.)

Worth Steel Co., Claymont, Del., U.S.A. (*Steel plates.*) (PHILADELPHIA.)

Youngstown (The) Sheet & Tube Co., Youngstown, O., U.S.A. (PITTSBURGH.)

FIRMS IN COUNTRIES OTHER THAN GREAT BRITAIN AND IRELAND.

ARRANGED ACCORDING TO SURVEYING DISTRICTS.

AMSTERDAM.

N.V. Machinefabriek G. Dikkers & Co., Hengelo, Holland. (*Small steel castings.*)

Nederlandsche Staalfabrieken (v/h J. M. de Muinck Keizer), Utrecht, Holland. (*Steel ingots, blooms, billets and castings.*)

ANTWERP.

Aciéries de Haine St. Pierre et Lesquin, Société Anonyme, Haine St. Pierre, Belgium. (*Steel castings.*)

Aciéries et Ateliers de Grosse Forge, Maurice Dembiermont & Cie., Hautmont (Nord), France. (*Steel forgings.*)

Compagnie Générale des Aciers, Société Anonyme, Thy-le-Chateau, Belgium. (*Steel castings.*)

Forges et Ateliers de Constructions Electriques de Jeumont, Jeumont (Nord), France. (*Steel castings.*)

Société Anonyme Baume et Marpent, Marpent (Nord), France. (*Steel castings.*)

Société Anonyme d'Angleur-Athus.
Works at Grivegnée. *Works* at Tilleur-lez-Liége. (*Rolling Mills for bars and sections only.*)

Société Anonyme d'Escaut & Meuse, Anzin (Nord), France.

Société Anonyme de la Fabrique de Fer de Charleroi, Charleroi, Belgium. (*Steel ingots and plates.*)

Société Anonyme de la Fabrique de Fer de Maubeuge, Louvroil (Nord), France. (*Steel ingots and plates.*)

Société Anonyme des Aciéries de la Meuse, Cheratte-lez-Liége, Belgium. (*Steel castings.*)

Société Anonyme des Aciéries Valère Mabille, Mariemont, Belgium. (*Small steel castings.*)

Société Anonyme des Forges de Vireux-Molhain, Vireux-Molhain, Ardennes, France. (*Plates, bars and sections.*)

Société Anonyme des Forges et Laminoirs de Baume, Haine St. Pierre, Belgium. (*Rolling Mills for bars and sections.*)

Société Anonyme des Forges, Usines & Fonderies de Haine St. Pierre, Haine St. Pierre, Belgium. (*Steel castings.*)

Société Anonyme des Hauts-Fourneaux, Forges & Aciéries de Denain et D'Anzin, Denain (Nord), France. (*Steel plates, round bars and steel castings.*)

Société Anonyme des Laminoirs, Hauts-Fourneaux, Forges & Fonderies de la Providence, Hautmont (Nord), France.

Société Anonyme d'Ougrée-Marihaye, Ougrée, near Liége, Belgium.

ANTWERP—*continued.*

Société Anonyme des Usines Gilson, La Croyère (Bois d'Haine), Belgium. (*Steel ingots, blooms, sections, rivet bars and forgings.*)

Société Anonyme John Cockerill, Seraing, Belgium.

Société Anonyme La Brugeoise et Nicaise & Delcuve, St. Michel-lez-Bruges, Belgium. (*Steel ingots, forgings and castings.*)

Société Anonyme Usines & Aciéries Leonard-Giot, Marchienne-au-Pont, Belgium. (*Steel castings.*)

Société Française de Constructions Mécaniques (Anciens Etablissements Cail), Denain (Nord), France. (*Steel ingots, blooms, bars, sheets, castings and forgings.*)

Travaux Métalliques de Boom, Société Coopérative, Boom, Belgium. (*Steel castings.*)

Union des Aciéries, Société Anonyme, Marcinelle, Charleroi, Belgium. (*Steel castings.*)

Usines & Aciéries Allard, Société Anonyme, Mont-sur-Marchienne, near Charleroi, Belgium. (*Steel castings.*)

Usines & Aciéries Allard, Société Anonyme, Turnhout, Belgium. (*Small steel castings.*)

Usines Emile Henricot, Court St. Etienne, Belgium. (*Steel castings.*)

Usines Gustave Boël (Aciéries de la Louvière), La Louvière, Belgium. (*Steel plates, sections, rivet bars and steel castings.*)

Usines Métallurgiques du Hainaut, Couillet, Belgium. (*Steel forgings, castings, bars and sections.*)

AUGSBURG.

Maschinenfabrik Augsburg-Nürnberg A.G., Augsburg, Germany. (*Steel forgings.*)

Stahlwerk Mannheim Akt. Ges., Mannheim-Rheinau, Germany. (*Steel castings and forgings.*)

BALTIMORE, MD.

Bethlehem Steel Co., Sparrow's Point, Md., U.S.A.

BARCELONA.

Fundiciones Escorsa S.A., Pi y Margall, 2-Hospitalet de Llobregat, Barcelona. (*Steel castings.*)

La Maquinista Terrestre y Maritima S.A., Barcelona. (*Steel castings.*)

Sociedad Anonima Industrias Mecanicas, Barcelona, Spain. (*Steel castings.*)

Sucesora de Aceros Electricos S.A., Barcelona, Spain. (*Steel castings.*)

BILBAO.

Compañía Anonima Basconia, Bilbao.

Compañia Fabrica de Trubia, Trubia Asturias, Spain. (*Steel castings and forgings.*)

Sociedad Altos Hornos de Vizcaya, Bilbao.

Sociedad Anonima Aceros de Elorrieta, Bilbao. (*Steel castings.*)

Sociedad Anonima Echevarria, Bilbao. (*Small sections and bars.*)

Sociedad Anonima Industrial Asturiana, Fabricas de Moreda y Gijon, Gijon. (*Rivet bars.*)

Sociedad Anonima Jose Maria Quijano, Forjas de Los Corrales de Buelna, Provincia de Santander, Spain. (*Steel bars.*)

Sociedad Anonima Talleres de Deusto, Deusto, Bilbao. (*Steel castings.*)

Sociedad Española de Construccion Naval, Reinosa, near Santander, Spain. (*Steel ingots, forgings, castings, plates, and sections.*)

Sociedad Metalurgica Duro-Felguera, La Felguera, Asturias, Spain.

BORDEAUX.

Compagnie des Forges et Aciéries de la Marine et d'Homécourt, Le Boucau (Forges de l'Adour), (Basses-Pyrénées), France. (*Bars and sections.*)

BOSTON.

Roxbury Steel Casting Co., Boston, Mass., U.S.A. (*Steel castings.*)

BOULOGNE.

Aciéries de Paris et d'Outreau (Société Anonyme), Usine d'Outreau (Pas de Calais), France. (*Steel castings.*)

BRAILA.

Uzinele de Fier si Domeniile din Resita, Societatea Anonima, Timisoara-Bucuresti.

BREMEN.

Deutsche Schiff und Maschinenbau Aktiengesellschaft, Werk Act. Ges. "Weser," Bremen, Germany. (*Small steel castings.*)

CALCUTTA.

Tata Iron & Steel Co., Lim., Jamshedpur, India. (*Steel plates, angles and channels.*)

CLEVELAND, O.

American Rolling Mill Co., Middletown, O., U.S.A. (*Steel castings and forgings.*)

American Steel Foundries, Indiana Harbor, Ind., U.S.A. (*Steel castings.*)

CLEVELAND, O.—*continued.*

Andrews Steel Co., Newport, Kentucky, U.S.A. (*Ingots, blooms, billets and slabs.*)

Atlas Steel Casting Co., Buffalo, N.Y., U.S.A. (*Steel castings.*)

Bethlehem Steel Co., Buffalo, N.Y., U.S.A.

Bonney-Floyd Co., Columbus, O., U.S.A. (*Steel castings.*)

Buhl Malleable Co., Detroit, Mich., U.S.A. (*Steel castings.*)

Canton Steel Foundry Co., Canton, O., U.S.A. (*Steel castings and ingots.*)

Carnegie-Illinois Steel Corporation, Chicago, Ill., U.S.A.

Cleveland Steel Casting Co., Cleveland, O., U.S.A. (*Steel castings.*)

Colorado (The) Fuel & Iron Co., Minnequa Works, Pueblo, Colo. (*Bars and small sections.*)

Detroit Steel Casting Co., Detroit, Mich., U.S.A. (*Steel castings.*)

Erie Forge Co., Erie, Pa., U.S.A. (*Steel ingots, forgings and castings.*)

Falk Corporation, Milwaukee, Wis., U.S.A. (*Steel castings.*)

Finkl (A.) & Sons Company, Chicago, Ill., U.S.A. (*Steel forgings.*)

Gould-Coupler Co., Depew, N.Y., U.S.A. (*Steel ingots.*)

Hubbard Steel Foundry Co., East Chicago, Ind., U.S.A. (*Steel castings.*)

Huntington Steel Co., Huntington, Ind., U.S.A. (*Steel castings.*)

Industrial Steel Castings Co., Toledo, O., U.S.A. (*Steel castings.*)

Inland Steel Co. (*Steel Works* at Indiana Harbor, Ind., U.S.A., and *Rolling Mills* at Chicago Heights, Chicago, Ill., U.S.A.)

Maynard Electric Steel Castings Co., Milwaukee, Wisconsin, U.S.A. (*Steel castings.*)

Michigan Steel Casting Co., Detroit, Mich., U.S.A. (*Small castings.*)

Monarch Steel Castings Co., Detroit, Mich., U.S.A. (*Steel castings.*)

National Enameling & Stamping Co., Granite City, Ill., U.S.A.

National Erie Co., Erie, Pa., U.S.A. (*Steel castings.*)

National Malleable and Steel Castings Co., Melrose Park, Chicago, Ill., U.S.A. (*Steel ingots.*)

National Steel Foundries Co., Milwaukee, Wis., U.S.A. (*Steel castings.*)

National Tube Co., Lorain, O., U.S.A. (*Blooms, billets and plates.*)

Northwestern Steel and Iron Corporation, Minneapolis, Minn., U.S.A. (*Steel castings.*)

Ohio Steel Foundry Co., Lima, O., U.S.A.

CLEVELAND, O.—*continued.*

Otis Elevator Co., Buffalo, N.Y., U.S.A. (*Steel castings.*)

Otis Steel Co. (The), Cleveland, O., U.S.A.

Pelton Steel Co., Milwaukee, Wis., U.S.A. (*Steel castings.*)

Railway Steel Spring Co., Chicago Heights, Ill., U.S.A. (*Steel ingots.*)

Republic Steel Corporation, Cleveland, O., U.S.A.

Buffalo Plant, Buffalo, N.Y., U.S.A.

Central Alloy District, Massillon Plant, Massillon, O., U.S.A.

Chicago Plant, Chicago, Ill., U.S.A. (*Steel Works* at 118th Street, Chicago, and *Rolling Mills* at East Chicago, Ind.) (*Steel angles and bars.*)

Cleveland District, Cleveland, O., U.S.A.

Corrigan McKinney Plant. (*Steel ingots, blooms and billets.*)

Upson Nut Plant. (*Round and square steel bars.*)

Scullin Steel Co., St. Louis, Mo., U.S.A. (*Steel castings.*)

Steel & Tube Co. of America, Mark Plant, Indiana Harbor, Ind., U.S.A.

Strong Steel Foundry Co., Buffalo, N.Y., U.S.A. (*Steel castings.*)

Toledo Steel Casting Co., Toledo, O., U.S.A. (*Steel castings.*)

Twin City Forge and Foundry Co., Stillwater, Minnesota, U.S.A. (*Steel castings.*)

Wellman-Seaver-Morgan Co., Cleveland, O., U.S.A. (*Steel castings.*)

Western Crucible Steel Casting Co., Minneapolis, Minn., U.S.A. (*Steel castings.*)

COPENHAGEN.

Burmeister & Wain's Maskin-og Skibsbyggeri, Aktieselskabet, Copenhagen. (*Steel ingots, forgings and castings.*)

Varde Staalvaerk, Varde, Denmark. (*Steel ingots and castings.*)

DORTMUND.

Dortmund-Hoerder Hüttenverein Aktiengesellschaft, Dortmund, Werk Dortmunder Union, Dortmund, Germany. (*Also steel castings.*)

Dortmund-Hoerder Hüttenverein Aktiengesellschaft, Dortmund, Werk Hoerder Verein, Dortmund-Hoerde, Germany.

Gusstahlwerk Wittmann Aktiengesellschaft, Haspe, near Hagen, Westphalia, Germany. (*Steel castings.*)

Hoesch-Köln Neuessen Aktiengesellschaft für Bergbau und Hüttenbetrieb, Dortmund, Germany. (*Rolling Mills.*)

DORTMUND—*continued.*

Klöckner-Werke A. G., Abteilung Hasper Eisen-und Stahlwerk, Haspe, Westphalia, Germany. (*Steel ingots, plates, bars and sections.*)

Mannesmannröhrenwerke, Abteilung Grillo Funke, Gelsenkirchen-Schalke, Westphalia, Germany.

Ruhrstahl Aktiengesellschaft, Annener Guss stahlwerk. Witten-Annen, near Dortmund, Westphalia, Germany. (*Steel castings.*)

Ruhrstahl Aktiengesellschaft, Gelsenkirchener Guss stahlwerke, Gelsenkirchen, Germany. (*Steel castings.*)

Ruhrstahl Aktiengesellschaft Guss stahlwerk Witten, Witten, Germany. (*Steel sections, bars and forgings.*)

Ruhrstahl Aktiengesellschaft Henrichshütte, Hattingen-Ruhr, Germany. (*Steel ingots, forgings, castings and plates.*)

Stahlwerk Mark Wengern, Aktiengesellschaft Wengern Ruhr, Germany. (*Steel castings.*)

DUNKIRK.

Aciéries de Haine St. Pierre & Lesquin, Lesquin-lez-Lille (Nord), France. (*Steel castings.*)

Compagnie de Fives Lille, Société Anonyme, Fives Lille (Nord), France. (*Steel ingots, castings and forgings.*)

Compagnie des Forges de Chatillon, Commentry et Neuves-Maisons, Isbergues (Pas de Calais), France. (*Steel blooms, bars and sections.*)

DÜSSELDORF.

August Thyssen-Hütte Aktiengesellschaft, Duisburg-Hamborn, Werk Hütte Ruhrort-Meiderich, Duisburg-Meiderich, Germany. (*Bars and sections only.*)

August Thyssen-Hütte Aktiengesellschaft, Duisburg-Hamborn, Werk Niederrheinische Hütte, Duisburg, Germany.

August Thyssen-Hütte Aktiengesellschaft, Duisburg-Hamborn, Werk Thyssen-Hütte, Duisburg-Hamborn, Germany. (*Bars and sections only.*)

Bergische Stahl-Industrie Kommanditgesellschaft, Remscheid, Germany. (*Steel ingots and castings.*)

Bochumer Verein für Gussstahlfabrikation Aktiengesellschaft, Bochum, Werk Bochum, Germany. (*Forgings, steel castings, rolled bars and weldless tubes.*)

Deutsche Babcock & Wilcox Dampfkessel-Werke Actien-Gesellschaft, Oberhausen, Germany. (*Steel castings.*)

Deutsche Edelstahlwerke A.G., Krefeld.

Krefelder Stahlwerk, Krefeld. (*Steel ingots and forgings.*)

Bergische Stahlindustrie, Remscheid. (*Steel forgings.*)

Deutsche Eisenwerke Aktiengesellschaft, Mülheim-Ruhr, Werk Friedrich Wilhelm-Hütte, Mülheim-Ruhr, Germany. (*Steel castings.*)

Deutsche Röhrenwerke Aktiengesellschaft, Düsseldorf, Werk Dinslaken, Niederrhein, Germany. (*Weldless tubes, hollow pillars and masts.*)

DÜSSELDORF—*continued.*

Deutsche Röhrenwerke Aktiengesellschaft, Düsseldorf, Werk Düsseldorf, Germany.

Deutsche Röhrenwerke Aktiengesellschaft, Düsseldorf, Werk Mülheim-Ruhr, Germany. (*Steel plates, seamless and lap-welded tubes.*)

Eisen-und Hüttenwerke Aktiengesellschaft, Bochum, Germany. (*Steel forgings and castings.*)

Gebr. Böhler & Co., A.G., Stahlwerk Dusseldorf, Dusseldorf-Oberkassel, Germany. (*Ingots for steel forgings.*)

Geisweider Eisenwerke Act. Ges., Geisweid (Kreis Siegen), Germany. (*Rolling Mills.*)

Gutehoffnungshütte Oberhausen Aktiengesellschaft, Abteilung Düsseldorf, Düsseldorf - Grafenberg, Germany. (*Steel castings.*)

Gutehoffnungshütte Oberhausen Aktiengesellschaft, Oberhausen, Rheinland, Germany.

Hahnsche Werke Act. Ges., Grossenbaum, near Duisburg, Germany. (*Broad flats and ingots.*)

Hüttenwerke Siegerland Aktiengesellschaft, Siegen, Werk Charlottenhütte, Niederschelden (Sieg), Germany. (*Steel plates and ingots.*)

Klöckner-Werke A. G., Abteilung Georgs-Marien-Werke, Osnabrück, Germany. (*Steel ingots, sections, forgings and castings.*)

Klöckner-Werke A.G., Abteilung Mannstaedtwerke, Troisdorf, near Cologne, Germany. (*Rolling Mills for sections.*)

Krupp, Fried., Act. Ges., Essen, Germany. (*Steel plates, forgings and castings.*)

Krupp, Fried. Act. Ges., Friedrich Alfred Hütte, Rheinhausen-Friemersheim, Germany. (*Bars and sections only.*)

Mannesmannröhren-Werke, Abteilung Heinrich Bierwes-Hütte, Duisburg-Huckingen, Germany. (*Steel Works and Rolling Mills for plates, bars and sections.*)

Mannesmannröhrenwerke, Düsseldorf and Remscheid, Germany. (*Weldless rolled or drawn steel hollow pillars and davits.*)

Press & Walzwerk Akt. Ges., Abteilung Oberbilker Stahlwerk, Düsseldorf-Oberbilk, Germany. (*Steel ingots and forgings.*)

Rheinmetall-Borsig Aktiengesellschaft, Werk Düsseldorf, Germany. (*Steel ingots and forgings; and weldless steel tubes.*)

Ruhrstahl Aktiengesellschaft, Stahlwerk Krieger, Düsseldorf, Germany. (*Steel castings.*)

Stahlwerk Gebr. Boehler, Act. Ges., Düsseldorf-Oberkassel. (*Ingots for steel forgings.*)

GDYNIA.

Schichau, F., Elbing, West Prussia, Germany. (*Steel ingots, forgings and castings.*)

Spolka Akcyjna Wielkich Piecow i Zakladow, Ostrowiekich, Poland. (*Steel castings, forgings, sections and small plates.*)

GENOA.

A.S.S.A. Acciaierie di Susa Società Anonima, Torino, Italy; Head Office in Turin. (*Works* at Susa.) (*Small steel castings.*)

Acciaieria e Ferriera del Caleotto, Società Anonima, Lecco riparto Castello, Italy. (*Steel ingots, bars and small sections.*)

Acciaierie Elettriche Pio Faggian, La Spezia, Italy. (*Small steel castings.*)

Acciaierie e Ferriere Lombarde Falck; *Head Office*, Milan. (*Works* at Milan, *weldless rolled or drawn steel tubes and hollow pillars.*) ("Unione" *Works* at Sesto S. Giovanni, *steel ingots, sections and bars.*) ("Concordia" *Works* at Sesto S. Giovanni, *Rolling Mills for steel plates.*)

Acciaieria e Tubificio di Brescia, Società Anonima, Brescia, Italy. (*Steel ingots, sections and bars, steel castings, weldless drawn or water gas welded tubular material.*)

Cantieri del Tirreno, Società Anonima Stabilimento alle Grazie, Genoa. (*Steel forgings.*)

Fabbrica Italiana Tubi, Società Anonima, Sestri Levante, Italy. (*Steel ingots, billets and weldless rolled and drawn steel tubes.*)

Fonderia Milanese di Acciaio Vanzetti, Milan. (*Steel castings.*)

Fratelli Bruzzo-Ferriera di Bolzaneto, Genova-Bolzaneto. (*Steel plates up to 25 mm. thickness, also sections and bars.*)

Fratelli Ferreri di Ferreri Nicola, Turin, Italy. (*Small steel forgings.*)

Grandi Fucine Italiane-Gio. Fossati & Co., Società Anonima, Genoa-Sestri, Italy. (*Steel forgings.*)

"Ilva" Alti Forni e Acciaierie d'Italia: Head Office, Genoa.

- Stabilimento di Genova-Sestri. (*Sections, bars and plates.*)
- Stabilimento di Genova-Bolzaneto. (*Sections and bars.*)
- Stabilimento di Genova-Voltri. (*Small sections, bars and rivets.*)
- Stabilimento di Savona. (*Sections, bars and plates.*)
- Stabilimento di Lovere. (*Sections, bars, castings and forgings.*)
- Stabilimento di Novi Ligure. (*Rolling Mills for steel plates up to 15 mm. in thickness; also sections and bars.*)
- Officine Metallurgiche Bergamasche, Società Anonima, Bergamo, Italy. (*Small steel forgings.*)

Società Alti Forni e Acciaierie d'Italia, Porto Vecchio di Piombino, Italy. (*Steel ingots, blooms, sections and bars.*)

Società Anonima Acciaierie Elettriche di Sesto San Giovanni, Sesto San Giovanni, Milan, Italy. (*Steel castings.*)

Società Anonima FIAT

- Sezione Ferriere, Piemontesi, Turin. (*Steel ingots, plates, sections, also seamless and welded tubes.*)
- Sezione Industrie Metallurgiche Acciaierie, Turin. (*Steel castings and forgings.*)

GENOA—*continued.*

Società Anonima Nazionale Cogne-Miniere, Alti Forni Acciaierie (Head Office, Turin; *Works* at Aosta.) (*Steel ingots, forgings, plates, sections and bars.*)

Società Italiano Acciaierie Cornigliano (*Head Office and Works* at Genova-Cornigliano.) (*Steel ingots, forgings, castings, plates and sections.*)

Società Italiana Ernesto Breda, Sesto S. Giovanni, Milan, Italy. (*Steel ingots, sections, forgings and steel castings.*)

Società Nazionale delle Officine di Savigliano. (*Head Office*, Turin; *Works* at Savigliano.) (*Steel ingots, forgings and castings.*)

Stabilimenti di Dalmine, Società Anonima, Dalmine (Bergamo). (*Weldless rolled or drawn steel tubes, hollow pillars and davits, and iron and steel lap welded tubes.*)

Tosi (Franco), Legnano, Italy. (*Steel forgings and castings.*)

GOTHENBURG.

Aktiebolaget Bofors, Bofors, Sweden. (*Melting Furnaces and Foundry* at Bofors.)

Aktiebolaget Motala Verkstad, Motala Verkstad, Sweden. (*Melting Furnaces, Rolling Mills and Forge; also steel castings.*)

Björneborgs Jernverks Aktiebolag, Vermlands Björneborg, Sweden. (*Melting Furnaces and Forge.*)

Strömsnäs Jernverks Aktiebolag, Degerfors, Sweden. (*Melting Furnaces and Rolling Mills.*)

Uddeholms Aktiebolag, Uddeholm, Sweden. Nykroppa, Sweden. (*Steel ingots, forgings and bars.*)

HAKODATE.

Hakodate Dock Co., Lim., Hakodate, Japan. (*Small steel forgings and castings.*)

The Japan Steel Works, Lim., Muroran, Japan. (*Steel ingots, forgings and castings.*)

HALIFAX, N.S.

Cumming (J. W.) Manufacturing Co., Lim., New Glasgow, Nova Scotia. (*Small steel castings.*)

Dominion Steel & Coal Corporation Lim., Sydney, Nova Scotia. (*Steel ingots, billets, plates and sections.*)

Nova Scotia Steel & Coal Co., Lim. (*Rolling Mills* at New Glasgow, N.S.) (*Forgings, sections and bars.*)

HAMBURG.

Blohm & Voss, Hamburg, Germany. (*Steel castings.*)

Deutsche Werke A.G., Kiel, Germany. (*Steel castings.*)

Nordische Stahlwerke, Bach & Co. Kommanditgesellschaft, Neumünster, Germany. (*Small steel castings.*)

Van Tongelsche Stahlwerke G.m.b.H., Güstrow i. M., Germany. (*Steel castings.*)

HAVRE.

Société Métallurgique de Normandie, Mondeville (Calvados), France.

HELSINGBORG.

Kockums Jernverk, Kallinge, Sweden. (*Steel castings.*)

HELSINGFORS.

Aktiebolaget Dalsbruk, Dalsbruk, Finland. (*Steel ingots, forgings, castings, bars and angles.*)

HONG KONG.

Hong Kong & Whampoa Dock Co., Lim., Kowloon Docks, Hong Kong. (*Steel castings.*)

KOBE.

Gomei Kaisha Miki Cast Steel Works, Lim., Osaka, Japan. (*Small steel castings.*)

Japan Steel Works, Lim., Hiroshima Works, Hiroshima, Japan. (*Steel ingots, forgings and castings.*)

Kaneko Steel Foundry, Minato-ku, Osaka, Japan. (*Steel castings.*)

Kawasaki Dockyard Co., Lim. (Fukiai Works), Kobe, Japan.

Kawasaki Sharyo Kabushiki Kaisha, Shiri-ike-mura, Hiogo, Japan. (*Steel castings and forgings.*)

Kobe Steel Works, Lim., Kobe, Japan. (*Steel castings, forgings, and plain and angle bars of small section.*)

Kurimoto Iron Works, Lim., 77, Shinsumiya-cho, Taisho-ku, Osaka. (*Steel castings.*)

Matsuo Chuko Kabushiki Kaisha, Osaka, Japan. (*Steel castings.*)

Mitsu Bishi Seitetsu Kabushiki Kaisha, Kenjiho, Korea.

Mitsubishi Jukogyo Kabushiki Kaisha, Kobe, Japan. (*Steel castings.*)

Mitsui Bussan Kaisha, Tama Yard, Tama, Japan. (*Steel castings.*)

Muto Denki Seikosho (Muto Electric Steel Works), Osaka, Japan. (*Steel castings.*)

Nakayama Steel Works, Lim., Osaka, Japan. (*Steel ingots and plates.*)

Niigata Tekkosho, Niigata, Japan. (*Steel castings.*)

Nippon Seitetsu Kabushiki Kaisha, Osaka Seitetsu-sho, Japan. (*Small steel angles and bars.*)

Nippon Steel Foundry, Lim., Osaka, Japan. (*Steel castings.*)

Osaka Chain and Machinery Works, Lim., Osaka, Japan. (*Small steel castings.*)

Osaka Iron Works, Lim., Sakurajima Works, Osaka, Japan. (*Steel castings and forgings*).

Sumitomo Metal Industries, Lim.
Steel Works, Osaka. (*Steel castings and forgings.*)
Steel Tube Works, Amagasaki. (*Ingots, small bars and sections; also weldless steel tubes.*)

LOS ANGELES.

Bethlehem Steel Corporation, Los Angeles, Cal., U.S.A. (*Round bars.*)

MALMÖ.

Aktiebolaget Abjörn Anderson, Svedala, near Malmö, Sweden. (*Steel castings.*)

5c.1

Duplicate

1E

Received by Chief Engineer Surveyor ..... *Received from Chief Engineer Surveyor* .....

VESSEL'S NAME Moulta Rpt. Eol No. 12147

The remarks of the Chief Engineer Surveyor are desired on this case for the consideration of the Classing Committee.

("The endorsement to contain a succinct summary of any repairs that have been required and to show the cause or causes of such repairs, and also to bring out clearly any exceptional features in connection with the case, so that the Classing Committee may have all the salient points presented in the endorsement."—*Extract from Sub-Committee's Report*, 24/5/92.)

Type of Engine Quadruple Expansion

4 Cy. 13¾"; 21 5/8", 26", 44 1/8" — 31½" Stroke

& Exhaust turbine driving steam Compressor.

If Boilers fitted with forced draught yes

Tail Shaft. If fitted with a continuous liner no

If fitted with an outside gland of approved type } yes.

This vessel's machinery appears to have been built in accordance with the Rules and the approved plans, and it is submitted she is eligible to be classed L.M.C 1.45

Sjt.

The machinery requirements for the notation "Strengthened for navigation in Ice" have been complied with

Not for S.R.L. Feed water economiser to be examined at B.S.

See also attached endorsement dated 5.3.45

.0703

MARSEILLES.

Fonderies & Aciéries de Provence, Marseilles. (*Steel castings.*)

MELBOURNE.

Ruwolt (Charles) Proprietary, Lim., Richmond, Melbourne. (*Steel castings.*)

Steel Company of Australia, Brunswick, Melbourne. (*Steel castings.*)

Thompson's Engineering & Pipe Co., Lim., Williamstown, Victoria. (*Steel castings.*)

METZ.

Aciéries Réunies de Burbach-Eich-Dudelange (Arbed). (*Works* at Burbach (Saarbrucken-Burbach). *Ingots, blooms, billets and sections*); (*Works* at Hostenbach (Saarbrucken-Burbach). *Rolling Mills for plates*); (*Works* at Dommeldange, Luxembourg. *Steel ingots, forgings and castings.*)

Aciéries Sarroises Dingler, Karcher et Cie., Saarbrück. (*Steel castings.*)

Compagnie des Forges et Aciéries de la Marine et d'Homécourt, Homécourt (Meurthe & Moselle).

Hauts-Fourneaux, Fonderies, Forges & Laminoirs de Meurthe & Moselle (Mr. Fould-Dupont), Usines de Pompey, France.

Neunkircher Eisenwerke A.G., Neunkirchen (Saar.) (*Steel bars and sections; also steel rivet bars.*)

Rochling'sche Eisen-und Stahlwerke, Volklingen-Saar. (*Steel ingots, billets, bars, forgings and castings.*)

Société Anonyme des Forges et Aciéries de Dilling, Dillingen-Saar.

Société Anonyme des Hauts-Fourneaux de la Chiers, Longwy Bas, France. (*Rounds for rivets, stays and bolts.*)

Société des Aciéries de Longwy, Mont St. Martin (Meurthe & Moselle), France.

Société Métallurgique de Senelle-Maubeuge, Senelle, near Longwy, Meurthe et Moselle, Metz. (*Steel ingots, blooms, bars and sections.*)

Union de Consommateurs de Produits Métallurgiques et Industriels, Usines d'Hagondange, Moselle. (*Steel blooms, billets, bars and sections.*)

Wendel, les Petits Fils de Fois. de, Usine "Fenderie," Hayange, Moselle.

MOBILE, ALA.

Gulf States Steel Co., Alabama City, Alabama, U.S.A.

Tennessee Coal, Iron & Railroad Co., Birmingham, Ala., U.S.A. (*Steel Works* at Ensley, Ala., and *Rolling Mills, also forgings*, at Bessemer and Fairfield, Ala.)

MONTREAL.

Canadian Car and Foundry, Steel Foundry Division, Longue Pointe, Montrea . (*Steel castings.*)

Canadian Tube and Steel Products, Lim., 5765, Hamilton Street, Montreal, P.Q. (*Steel angles, bars and rivets.*)

Joliette Steel, Lim., Joliette, Quebec. (*Steel castings.*)

Steel Company of Canada, Hamilton, Ontario. (*Works* at Montreal.) (*Bars and angles.*)

NAGASAKI.

Asano Kokura Steel Co., Lim., Konomimachi, Kokura, Japan. (*Ingots.*)

Mitsubishi Jukogyo Kabushiki Kaisha, Nagasaki, Japan. (*Steel ingots, blooms, forgings, castings and plates.*)

Nippon Seitetsu Kabushiki Kaisha, Yawata Seitetsu-sho, Yawata, Japan.

Tokai Kogyo Kaisha, Lim., Wakamatsu, Japan (*Rolling Mills for plates and angles.*)

NANTES.

Etablissements J. J. Carnaud & Forges de Basse-Indre, Basse-Indre, Loire-Inférieure. (*Also steel castings.*)

Forges & Aciéries du Nord et de l'Est (France), Usines Métallurgiques de la Basse Loire, Trignac, near St. Nazaire.

Société Anonyme des Aciéries Nantaises, Nantes. (*Steel castings.*)

NAPLES.

Ilva Alti Forni e Acciaierie d'Italia.

Stabilimento di Bagnoli, Bagnoli. (*Steel ingots, sections and bars.*)

Stabilimento di Torre Annunziata Centrale, Torre Annunziata Centrale. (*Steel ingots, sections and bars.*)

"Terni" Società per l'Industria e l'Elettricità. (*Works* at Terni.) (*Steel ingots, forgings, castings and plates.*)

NEWCASTLE, N.S.W.

Broken Hill Proprietary Co., Lim., Iron and Steel Works, Newcastle, N.S.W. (*Steel plates, bars sections and castings.*)

Commonwealth Steel Co., Lim., Waratah, Newcastle N.S.W. (*Steel castings and forgings.*)

NEWPORT NEWS, VA.

Newport News Shipbuilding & Dry Dock Co., Newport News, Va., U.S.A. (*Steel castings and forgings.*)

OSLO.

Drammens Jernstoberi A/S., Drammen, Norway. (*Small steel castings.*)

Raufoss Ammunisjonsfabrikker, Raufoss, Norway. (*Steel castings.*)

Stavanger Electro-Staalverk A/S., Stavanger, Norway. (*Steel castings.*)

Strömmens Verksted, near Oslo. (*Steel castings.*)

PARIS.

Aciéries de Gennevilliers, Gennevilliers, near Paris. (*Small steel castings.*)

PHILADELPHIA, PA.

Alan Wood Steel Company, Conshohocken and Ivy Rock, Pa., U.S.A. (*Blooms, billets and thin plates.*)

American Bridge Co., Pencoyd Iron Works, Pencoyd, Philadelphia, Pa., U.S.A. (*Sections, angles and bars.*)

Atlantic Steel Castings Co., Chester, Pa., U.S.A. (*Steel castings.*)

Bethlehem Steel Co., Bethlehem, Pa., U.S.A. (*Steel ingots, bars and sections.*)

Lebanon, Pa., U.S.A. (*Rolling Mills for bars.*)

Steelton, Pa., U.S.A. (*Steel forgings.*)

Central Iron & Steel Co., Harrisburg, Pa., U.S.A. (*Rolling Mills.*)

Dodge Steel Company, Tacony, Philadelphia, Pa., U.S.A. (*Small steel castings.*)

General Steel Castings Corporation, Eddystone, Pa., U.S.A. (*Steel castings.*)

Lebanon Steel Foundry, Lebanon, Pa., U.S.A. (*Small steel castings.*)

Lukens Steel Company, Coatesville, Pa., U.S.A.

Midvale Company, (The), Nicetown, Philadelphia, Pa., U.S.A. (*Steel forgings.*)

Penn Steel Castings Corporation, Chester, Pa., U.S.A. (*Steel castings.*)

Pennsylvania Forge Corporation, Tacony, Philadelphia, Pa., U.S.A. (*Steel ingots and forgings.*)

Phœnix Iron Company (The), Phœnixville, Pa., U.S.A. (*Sections and bars.*)

Standard Steel Works Co., Burnham, Mifflin County, Pa., U.S.A. (*Steel castings and forgings.*)

Worth Steel Co., Claymont, Del., U.S.A. (*Steel plates.*)

PITTSBURGH, PA.

Allegheny Steel Co., Brackenridge, Pa., U.S.A. (*Also steel castings.*)

Bethlehem Steel Co., Cambria Works, Johnstown, Pa., U.S.A.

Carnegie-Illinois Steel Corporation, Pittsburgh, Pa., U.S.A.

Crucible Steel Company of America, Park Works, Pittsburgh, Pa., U.S.A.

Forged Steel Wheel Company, Butler, Pa., U.S.A.

Jones & Laughlin Steel Corporation, Pittsburgh, Pa., U.S.A.

Mesta Machine Co., West Homestead, Pa., U.S.A. (*Steel ingots, castings and forgings.*)

National Malleable and Steel Castings Co., Sharon, Pa., U.S.A. (*Steel ingots.*)

Oliver Iron & Steel Co., Pittsburgh, Pa., U.S.A. (*Rolling Mills for bars.*)

Pittsburgh Crucible Steel Co., Midland, Pa., U.S.A.

Pittsburgh Steel Foundry, Glassport, Pa., U.S.A. (*Steel castings and ingots.*)

PITTSBURGH, PA.—*continued.*

Republic Steel Corporation, Cleveland, O., U.S.A.; Youngstown Plant, Youngstown, O., U.S.A.

Sharon Steel Hoop Co., Youngstown, O. (*Steel melting plant* at Lowellville, O.; and *Rolling Mills* at Youngstown, O.)

Sterling Steel Foundry Co., Braddock, Pa., U.S.A. (*Steel castings.*)

Union Steel Casting Co., Pittsburgh, Pa., U.S.A. (*Steel castings.*)

Wheeling Mold & Foundry Co., Wheeling, W. Va., U.S.A. (*Steel castings.*)

Wheeling Steel Corporation, La Belle Works, Steubenville, O., U.S.A.

Youngstown (The) Sheet & Tube Co., Youngstown, O., U.S.A.

PRAGUE.

Ceskomoravska-Kolben-Danek, Lim., Prague-Vysocany. (*Steel castings.*)

Ignaz Storek, Brünn, Czecho-Slovakia. (*Steel castings.*)

Limited Co., formerly the Skoda-Works, Pilsen. (*Steel castings and forgings.*)

Branch Works at Hradek, near Rokycany. (*Rolling mills for bars and sections.*)

Mannesmannröhrenwerke, Komotau, Czecho-Slovakia. (*Weldless steel tubes.*)

Poldi Steel Works, Kladno, near Prague.

Prazska zelezarska spolecnost, Kladno, near Prague.

ROTTERDAM.

Machine Fabriek Yzer-Staal & Metaal Gieterij (v/h Bakker & Co.), Ridderkerk. (*Steel castings.*)

ROUEN.

Aciéries de Maromme (E. Breton), Maromme (Seine Inférieure), France. (*Steel castings.*)

ST. ETIENNE.

Compagnie des Forges et Aciéries de la Marine et d'Homécourt, St. Chamond (Loire), France.

Fonderies, Forges et Aciéries de St. Etienne, St. Etienne, France.

Forges de la Loire et du Midi (Messrs. Marrel Frères), Rive de Gier, France.

Holtzer, Jacob, & Cie., Aciéries d'Unieux, Unieux (Loire), France. (*Steel forgings and castings.*)

Schneider & Co., Creusot.

Société Anonyme de Commentry-Fourchambault et Decazeville, Imphy (Nievre). (*Steel ingots, bars, sections, castings and forgings.*)

Société Anonyme des Aciéries & Forges de Firminy, Firminy (Loire), France. (*Steel castings.*)

SAN FRANCISCO, CAL.

Columbia Steel Company, Pittsburgh, Cal., U.S.A. (*Steel castings.*)

General Metals Corporation (Best Plant Division), Oakland, Cal., U.S.A. (*Steel castings.*)

Bethlehem Steel Corporation, South San Francisco, Cal., U.S.A. (*Steel ingots, small sections, and bars.*)

SEATTLE, WASH.

Olympic Steel Works, Seattle, Wash., U.S.A. (*Steel castings.*)

Bethlehem Steel Corporation, Seattle, Wash., U.S.A. (*Sections and bars.*)

Puget Sound Steel Works, Tacoma, Wash., U.S.A. (*Steel castings.*)

Washington Iron Works, Seattle, Wash., U.S.A. (*Steel castings.*)

STETTIN.

Deutsche Industrie Werke Aktiengesellschaft, Berlin-Spandau, Germany. (*Steel ingots, bars, sections and forgings.*)

Gruson (Otto) & Co., Eisen und Stahlwerk, Magdeburg Buckau, Germany. (*Steel castings.*)

Gusstahlwerk Wolgast Betriebs-Gesellschaft m.b.H., Wolgast, Germany. (*Small steel castings.*)

Krautheim (G.), Aktiengesellschaft, Chemnitz-Borna, Germany. (*Steel castings.*)

Krupp, Fried., Act. Ges., Grusonwerk, Magdeburg-Buckau, Germany. (*Steel castings.*)

Mitteldeutsche Stahlwerke Akt. Ges., Lauchhammerwerk Gröditz, Gröditz, Germany. (*Steel castings.*)

Mitteldeutsche Stahlwerke Akt. Ges., Lauchhammerwerk Riesa, Riesa, Germany. (*Rolling Mills for bars; seamless steel tubes.*)

Mitteldeutsche Stahlwerke Aktiengesellschaft, Stahl und Walzwerk Weber, Brandenburg (Havel), Germany. (*Steel plates and ingots.*)

Rheinmetall-Borsig Aktiengesellschaft, Werk Borsig, Berlin-Tegel, Germany. (*Steel ingots, forgings and castings.*)

Schäffer & Budenburg G.m.b.H., Magdeburg-Buckau, Germany. (*Small steel castings.*)

Stahl und Walzwerk Hennigsdorf Aktiengesellschaft, Hennigsdorf, near Berlin. (*Steel castings and forgings.*)

STOCKHOLM.

Avesta Jernverks Aktiebolag, Avesta, Sweden. (*Steel plates, sections, and high pressure air receivers.*)

Bultfabriks Aktiebolaget, Hallstahammar, Sweden. (*Steel castings.*)

Fagersta Bruks Aktiebolag, Fagersta, Sweden (Brukskoncernen).

Works at Fagersta. (*Steel blooms and billets.*)

Works at Forsbacka. (*Steel blooms, billets, tubes and forged and rolled bars.*)

STOCKHOLM—*continued.*

Kohlswa Jernverks Aktiebolag. (*Melting Furnaces, Foundry and Forge* at Kohlswa, Sweden.)

Sandvikens Jernverks Aktiebolag, Sandviken, Sweden. (*Steel ingots, forgings, and steel tubes.*)

Smedjebackens Valsverks Aktiebolaget, Smedjebacken, Sweden. (*Steel sections and castings.*)

Stora Kopparbergs Bergslags Aktiebolag, Falun, Sweden. (*Steel Works* at Domnarfvet.) (*Sections of all sizes and plates up to 30 mm. thick; steel castings.*)

Surahammars Bruks Aktiebolag, Surahammar, Sweden. (*Forge and Rolling Mills, also steel castings.*)

Uddeholms Aktiebolag, Uddeholm, Sweden; Storfors, Sweden. (*Weldless steel tubes.*)

SYDNEY, N.S.W.

Australian Alloy Steel, Lim., Alexandria, Sydney, N.S.W. (*Steel castings.*)

Australian Iron & Steel, Lim., Port Kembla, N.S.W. (*Steel plates, bars and sections.*)

Bradford & Kendall, Lim., Alexandria, Sydney, N.S.W. (*Steel castings.*)

Cockatoo Docks & Engineering Co., Lim., Cockatoo, Sydney, N.S.W. (*Steel castings.*)

TORONTO, ONTARIO.

Algoma Steel Corporation, Lim., Sault St. Marie, Ontario, Canada. (*Steel billets, bars and angles.*)

Canada Foundries & Forgings, Lim., Welland, Ontario. (*Steel forgings.*)

Dominion Foundries & Steel, Lim., Hamilton, Ontario. (*Steel ingots, plates and castings.*)

Steel Company of Canada, Hamilton, Ontario. (*Bars and angles.*)

TRIESTE.

"Ilva," Alti Forni e Acciaierie d'Italia, Marghera, Italy. (*Steel castings; also Rolling Mills for small steel sections and bars.*)

Kranjska Industrjska Druzba, Jesenice-Fuzine, Yugoslavia.

Società Anonima Fonderie Officine di Gorizia, Gorizia, Italy. (*Small steel castings.*)

VALENCIA.

Compania Siderurgica del Mediterraneo, Sagunto, Spain. (*Steel ingots, bars and sections.*)

VANCOUVER, B.C.

Vancouver Engineering Works, Lim., Vancouver, B.C. (*Steel castings.*)

VIENNA.

Works in Austria.

Böhler, Gebr., & Co., Akt. Ges., Vienna. (*Works* at Kapfenberg, Styria.) (*Steel castings.*)

Oesterreichisch-Alpine Montangesellschaft, Vienna. (*Works* at Donawitz, Styria. *Plates and sections.*) (*Works* at Kindberg, Styria, Austria. *Rolling Mills for small sections.*)

Schoeller-Bleckmann Stahlwerke Akt. Ges., Vienna. (*Works* at Hoenigsberg, Styria. *Steel bars.*) (*Works* at Ternitz, Nieder-Oesterreich. *Steel bars and castings; also seamless steel tubes.*)

Works in Czecho-Slovakia.

Banska a Hutni Spolecnost (Berg- & Huttenwerks-Gesellschaft), Praha, II. (*Works* at Trinec. *Steel ingots, bars and sections.*) (*Works* at Karlova Hut. *Rolling Mills for plates.*)

Hahn (Albert), Röhrenwalzwerke, Novy Bohumin. (*Steel ingots, bars and sections.*)

Mannesmannröhrenwerke Akt. Ges., Svinov-Vitkovice. (*Weldless steel tubes.*)

Statne Zeleziarne a Oceliarne, Podbrezova. (*Rolling Mills for plates and sections; also seamless steel tubes.*)

Vitkovice Mines, Steel and Ironworks Corporation, Mor. Ostrava, 10 (Witkowitzer Bergbau- & Eisenhütten-Gewerkschaft, Mahr. Ostrau, 10). (*Works* at Vitkovice.)

Works in Germany.

Vereinigte Oberschlesische Hüttenwerke Aktiengesellschaft, Gleiwitz, O/S. (*Works* "Herminenhütte" at Laband, O/S. *Rolling mills for small sections and bars.*) (*Works* "Julienhütte" at Bobrek, O/S. *Ingots, blooms and billets.*) (*Works* "Stadtwerke Gleiwitz" at Gleiwitz, O/S. *Steel ingots, blooms and forgings.*) (*Works* "Stahlrohrenwerke" at Gleiwitz, O/S., Stadtwald. *Seamless steel tubes.*) (*Works* "Zawadzkiwerke" at Zawadzki, O/S. *Rolling Mills for sections and bars.*)

Works in Hungary.

Ganz & Co., Akt. Ges., Budapest. (*Steel castings and forgings.*)

Königlich Ungarische Staatliche Eisen-, Stahl- und Maschinenfabriken, Budapest. (*Works* at Diösgyör.) (*Steel castings, forgings, plates and sections.*)

Rimamurany-Salgo-Tarjaner Eisenwerke Akt. Ges., Budapest. *Works* at Ozd.

Weiss Manfred, Stahl-und Metallwerke Aktiengesellschaft, Budapest. (*Works* at Budapest—Czepel.) (*Steel ingots and seamless steel tubes.*)

Works in Poland.

Huta Pokoj Sp. A. Katowice. (*Works* "Baildonhutte" at Katowice, G/S.) (*Works* "Huta Pokoj" at Nowy Bytom, G/S.)

VIENNA—*continued.*

Katowicka Sp. A. dla Gornictwa i Hutnictwa, Katowice. (*Works* "Huta Batorego" at Hajduki Wielkie, G/S. *Steel castings and weldless rolled or drawn steel hollow pillars and davits.*) (*Works* "Huta Falva" at Swientochlowice, G/S.) (*Works* "Krolewska Huta" at Krolewska Huta, G/S. *Steel plates, angles, bars and forgings.*) (*Works* "Huta Laura" at Siemianowice, G/S. *Steel plates, angles, bars and weldless tubes.*)

Modrzejowskie Zaklady Gorniczo-Hutnicze, S. A., Sosnowice. (*Works* at Huta Katarzyna. *Steel ingots.*) (*Works* at Huta Milowice. *Rolling Mills for blooms and round bars.*)

Société Anonyme des Forges et Acieries de Huta-Bankowa, Dabrowa-Gornicza, G/S.) (*Works* at Dabrowa, G/S. *Steel plates, sections and castings.*)

Société Anonyme des Usines de Fabrication de Tubes et de Forges de Sosnowice, Sosnowice, Poland. (*Seamless steel tubes*).

WINTERTHUR.

Société Anonyme des Aciéries ci-devant Georges Fischer, Schaffhouse, Switzerland. (*Steel castings.*)

Société des Usines de Louis de Roll, Gerlafingen, Switzerland. (*Steel ingots, round bars and forgings.*)

Sulzer Frères, Société Anonyme, Winterthur, Switzerland. (*Steel castings.*)

YOKOHAMA.

Mitsubishi Jukogyo Kabushiki Kaisha, Yokohama Dock Works, Yokohama, Japan. (*Steel ingots, blooms, small forgings and castings.*)

Nippon Chuzo Kabushiki Kaisha, 2-chome, Suehiro-cho, Tsurumi-ku, Yokohama, Japan. (*Steel castings.*)

Nippon Kokan Kabushiki Kaisha, Kawasaki, Japan. (*Steel tubes, bars and sections.*)

Oshima Steel Works, Oshima, Tokio, Japan. (*Steel castings and forgings.*)

Tokyo Kozai Kabushiki Kaisha,

Tokyo Works (*Steel ingots, bars and sections*);
Hirota Works (*Steel ingots.*)

Tsurumi Seitetsu Zosen Kabushiki Kaisha, Tsurumi, Kojo, Japan. (*Rolling Mills for plates.*)

Uraga Dock Co., Lim., Uraga, Japan. (*Steel castings.*)

(*Revised, September*, 1937.)

TABLES

OF

SCANTLINGS AND EQUIPMENT

FOR

STEEL VESSELS.

TABLES

OF

SCANTLINGS AND EQUIPMENT

FOR

STEEL VESSELS.

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KEELS, STEMS and STERNFRAMES. TABLE 1

FIRST LONGITUDINAL NUMERAL L × D		BAR KEELS.	STEMS.	STERNFRAMES WITHOUT APERTURES.	STERNFRAMES WITH APERTURES.	
Full Scantling Vessels.	Complete Superstructure Vessels.				Stern Post.	Rudder Post.
		mm.	mm.	mm.	mm.	mm.
95		150 × 25	140 × 25	140 × 25	135 × 55	125 × 55
140		165 × 32	145 × 29	145 × 32	140 × 70	135 × 70
185		180 × 38	150 × 32	150 × 38	145 × 85	140 × 85
230	280	180 × 44	160 × 35	160 × 44	150 × 95	145 × 95
280	325	185 × 47	165 × 38	165 × 50	160 × 110	145 × 110
325	370	190 × 50	170 × 41	170 × 54	165 × 115	145 × 115
370	420	190 × 57	180 × 44	180 × 57	170 × 125	150 × 125
420	465	195 × 60	185 × 47	185 × 60	180 × 135	160 × 135
465	555	210 × 60	190 × 50	190 × 63	190 × 140	170 × 140
555	650	215 × 63	190 × 54	205 × 67	215 × 140	190 × 140
650	790	230 × 67	205 × 57	230 × 67	230 × 145	205 × 145
790	930	255 × 67	215 × 57	240 × 70	240 × 160	215 × 160
930	1115	265 × 70	230 × 60	255 × 73	255 × 180	230 × 180
1115	1300	280 × 73	240 × 63	265 × 76	265 × 190	230 × 190
1300	1535		255 × 67	265 × 83	265 × 215	230 × 215
1535	1765		265 × 70	280 × 86	280 × 230	240 × 230
1765	2045		280 × 73	290 × 90	290 × 240	255 × 240
2045	2415		280 × 77	290 × 95	305 × 255	265 × 255
2415	2785		290 × 85	305 × 98	320 × 265	280 × 265
	3160		305 × 85	305 × 100	320 × 280	280 × 280
	3530		305 × 90	305 × 110	330 × 290	290 × 290

SIDE FRAMING.

FULL SCANTLING SINGLE DECK VESSELS—FLUSH DECK.

TABLE 2

(SEE CONTINUATION.)

D	FRAME SPACING.	TYPE OF FRAMING.	FRAMING IN PEAKS.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS TO DECK AT SIDE.				
				Metres. 2,45	Metres. 3,05	Metres. 3,65	Metres. 3,95	Metres. 4,25
Metres.	mm.		mm.	mm.	mm.	mm.	mm.	mm.
3,05	535	Frames						
		Reversed frames						
		Depth of framing						
		Angle frames	100 × 65 × 6,5	100 × 65 × 7	100 × 65 × 7,5	100 × 65 × 8	100 × 75 × 8,5	
3,35	545	Frames						
		Reversed frames..						
		Depth of framing						
		Angle frames	100 × 65 × 7	100 × 65 × 7,5	100 × 65 × 8	100 × 65 × 8,5	100 × 75 × 9	100 × 75 × 9,5
3,65	545	Frames					65 × 65 × 6	65 × 65 × 6,5
		Reversed frames					65 × 65 × 6	65 × 65 × 6,5
		Depth of framing					65	65
		Angle frames	100 × 65 × 7,5		100 × 65 × 8,5	120 × 75 × 8	120 × 75 × 8,5	130 × 75 × 7,5
3,95	560	Frames..				75 × 65 × 6	75 × 65 × 6,5	75 × 65 × 7
		Reversed frames				65 × 65 × 6	65 × 65 × 6,5	65 × 65 × 7
		Depth of framing				75	75	75
		Angle frames	100 × 65 × 8,5		120 × 75 × 8	130 × 75 × 8,5	130 × 75 × 9,5	140 × 75 × 8,5
4,25	560	Frames	65 × 65 × 6,5			75 × 75 × 7	75 × 75 × 7	75 × 75 × 7,5
		Reversed frames	65 × 65 × 6,5			65 × 65 × 7	75 × 65 × 7	75 × 65 × 7,5
		Depth of framing	65			75	90	90
		Angle frames	120 × 75 × 9,5			140 × 75 × 8,5	140 × 75 × 10	150 × 75 × 9,5
4,55	570	Frames	75 × 65 × 6,5			75 × 75 × 7	75 × 75 × 7,5	75 × 75 × 8
		Reversed frames	65 × 65 × 6,5			75 × 65 × 7	75 × 65 × 7,5	75 × 65 × 8
		Depth of framing	75			90	90	90
		Angle frames	130 × 75 × 9,5			140 × 75 × 10	150 × 75 × 9,5	170 × 75 × 8,5
4,9	570	Frames	90 × 65 × 6,5				75 × 75 × 8	75 × 75 × 8,5
		Reversed frames	65 × 65 × 6,5				75 × 65 × 8	75 × 75 × 8,5
		Depth of framing	90				90	90
		Angle or bulb angle frames	140 × 75 × 9				170 × 75 × 8,5	140 × 75 × 8

SIDE FRAMING.

FULL SCANTLING SINGLE DECK VESSELS—FLUSH DECK.

TABLE 2

(SEE CONTINUATION.)

D	FRAME SPACING.	TYPE OF FRAMING.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO DECK AT SIDE.					
			Metres. 4,55	Metres. 4,9	Metres. 5,2	Metres. 5,5	Metres. 5,8	Metres. 6,1
Metres.	mm.		mm.	mm.	mm.	mm.	mm.	mm.
3,05	535	Frames						
		Reversed frames						
		Depth of framing						
		Angle frames						
3,35	545	Frames						
		Reversed frames						
		Depth of framing						
		Angle frames						
3,65	545	Frames	75 × 65 × 6,5					
		Reversed frames	65 × 65 × 6,5					
		Depth of framing	75					
		Angle frames	130 × 75 × 9,5					
3,95	560	Frames	75 × 65 × 7	75 × 65 × 7,5				
		Reversed frames	75 × 65 × 7	75 × 65 × 7,5				
		Depth of framing	90	90				
		Angle frames	140 × 75 × 10	150 × 75 × 9,5				
4,25	560	Frames	75 × 75 × 8	75 × 75 × 7,5	75 × 75 × 8			
		Reversed frames	75 × 65 × 8	75 × 75 × 7,5	75 × 75 × 8			
		Depth of framing	90	90	90			
		Angle or bulb angle frames	170 × 75 × 8,5	170 × 75 × 9,5	140 × 75 × 7			
4,55	570	Frames	75 × 75 × 8	90 × 75 × 7,5	90 × 75 × 8	90 × 75 × 8		
		Reversed frames	75 × 75 × 8	75 × 75 × 7,5	75 × 75 × 8	90 × 75 × 8		
		Depth of framing	90	100	100	115		
		Bulb angle frames	140 × 75 × 7	140 × 75 × 8,5	140 × 75 × 10	150 × 75 × 10		
4,9	570	Frames	90 × 75 × 7,5	90 × 75 × 8	90 × 75 × 8	90 × 75 × 9	100 × 75 × 9	
		Reversed frames	75 × 75 × 7,5	75 × 75 × 8	90 × 75 × 8	90 × 75 × 9	90 × 75 × 9,5	
		Depth of framing	100	100	115	115	125	
		Bulb angle frames	140 × 75 × 8,5	140 × 75 × 10	150 × 75 × 10	170 × 75 × 8	170 × 75 × 11	

SIDE FRAMING.

FULL SCANTLING SINGLE DECK VESSELS—FLUSH DECK.

TABLE 2

(SEE CONTINUATION.)

D	FRAME SPACING.	TYPE OF FRAMING.	FRAMING IN PEAKS.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO DECK AT SIDE.					
				Metres. 4,25	Metres. 4,55	Metres. 4,9	Metres. 5,2	Metres. 5,5	Metres 5,8
Metres.	mm.		mm.	mm.	mm.	mm.	mm.	mm.	mm.
5,2	585	Frames	90×65× 7	90×75×7,5	90×75× 8	90×75× 8	90×75× 9	100×75× 8,5	120×75× 8,5
		Reversed frames	65×65× 7	75×75×7,5	75×75× 8	90×75× 8	90×75× 9	90×75× 9	90×75× 8,5
		Depth of framing	90	100	100	115	115	125	140
		Angle or bulb angle frames	140×75×10	140×75×8,5	140×75×10	150×75×10	170×75× 8	170×75× 9,5	180×75× 9
5,5	585	Frames	90×65× 7		100×75× 8	100×75× 8,5	100×75× 8,5	120×75× 8	120×75× 9
		Reversed frames	75×65× 7		75×75× 8,5	75×75× 9	90×75× 9	90×75× 8	90×75× 9
		Depth of framing	100		115	115	125	140	140
		Angle or bulb angle frames	150×75×10		150×75×10	150×75×11	170×75× 9,5	170×75×11,5	180×75×10
5,8	595	Frames	90×75× 7			100×75× 8,5	120×75× 8	120×75× 9	120×75×10
		Reversed frames	75×65× 7			90×75× 9	90×75× 8	90×75× 9	100×75×10,5
		Depth of framing	100			125	140	140	140
		Angle or bulb angle frames	170×75× 8,5			170×75× 9,5	170×75×11,5	180×75×10	190×75× 9
6,1	595	Frames	90×75× 7,5				120×75× 9,5	120×75×10	120×75×10
		Reversed frames	75×65× 7,5				100×75×10	100×75×10,5	120×75×10
		Depth of framing	100				140	140	150
		Angle or bulb angle frames	170×75× 9				180×75×11	190×75× 9	190×75×11
6,4	610	Frames	90×75× 7,5					120×75×10,5	130×75×10
		Reversed frames	75×75× 7,5					120×75×10,5	120×75×10
		Depth of framing	100					150	165
		Bulb angle frames	140×75× 8,5					200×75×10	200×75×10,5
6,7	610	Frames	90×75× 8						130×75×10
		Reversed frames	75×75× 8						130×75×10
		Depth of framing	100						180
		Bulb angle frames	140×75×10						220×75×10
7,0	620	Frames	90×75× 8,5						130×75×11
		Reversed frames	75×75× 8,5						130×75×11
		Depth of framing	100						180
		Bulb angle frames	150×75× 8						220×75×11,5

SIDE FRAMING.

FULL SCANTLING SINGLE DECK VESSELS—FLUSH DECK.

TABLE 2

(SEE CONTINUATION.)

D	FRAME SPACING.	TYPE OF FRAMING.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO DECK AT SIDE.						
			Metres. 6,1	Metres. 6,4	Metres. 6,7	Metres. 7,0	Metres. 7,3	Metres 7,6	Metres. 7,9
Metres.	mm.		mm.	mm.	mm.	mm.	mm.	mm.	mm.
5,2	585	Frames	120 × 75 × 9,5						
		Reversed frames	100 × 75 × 10						
		Depth of framing	140						
		Bulb angle frames	180 × 75 × 11						
5,5	585	Frames	120 × 75 × 9,5	130 × 75 × 9,5					
		Reversed frames	120 × 75 × 9,5	120 × 75 × 9,5					
		Depth of framing	150	165					
		Bulb angle frames	190 × 75 × 10	200 × 75 × 10					
5,8	595	Frames	120 × 75 × 10	130 × 75 × 10	130 × 75 × 10				
		Reversed frames	120 × 75 × 10	120 × 75 × 10	130 × 75 × 10				
		Depth of framing	150	165	180				
		Bulb angle frames	190 × 75 × 10,5	200 × 75 × 10,5	200 × 75 × 13,5				
6,1	595	Frames	130 × 75 × 9,5	130 × 75 × 10,5	130 × 75 × 10,5	140 × 75 × 10,5			
		Reversed frames	120 × 75 × 9,5	120 × 75 × 10,5	130 × 75 × 10,5	130 × 75 × 10,5			
		Depth of framing	165	165	180	190			
		Bulb angle frames	200 × 75 × 10	200 × 75 × 11,5	220 × 75 × 10,5	220 × 75 × 13			
6,4	610	Frames	130 × 75 × 10,5	130 × 75 × 10,5	140 × 75 × 10	140 × 75 × 10,5	150 × 75 × 11		
		Reversed frames	120 × 75 × 10,5	130 × 75 × 10,5	130 × 75 × 10	140 × 75 × 10,5	140 × 75 × 11,5		
		Depth of framing	165	180	190	205	215		
		Bulb angle frames	200 × 75 × 11,5	220 × 75 × 10,5	220 × 75 × 12	220 × 75 × 13,5	240 × 90 × 12		
6,7	610	Frames	130 × 75 × 11	140 × 75 × 10,5	140 × 75 × 10	140 × 75 × 11	150 × 75 × 11,5	150 × 75 × 12	
		Reversed frames	130 × 75 × 11	130 × 75 × 10,5	140 × 75 × 10	140 × 75 × 11	140 × 75 × 12	150 × 75 × 12	
		Depth of framing	180	190	205	205	215	230	
		Bulb angle frames	220 × 75 × 11,5	220 × 75 × 13	220 × 75 × 13	220 × 75 × 14	240 × 90 × 12,5	250 × 90 × 12,5	
7,0	620	Frames	140 × 75 × 11	140 × 75 × 11	150 × 75 × 11				
		Reversed frames	130 × 75 × 11	140 × 75 × 11	140 × 75 × 11,5				
		Depth of framing	190	205	215				
		Bulb angle frames	220 × 75 × 12	220 × 75 × 14	240 × 90 × 12				

SIDE FRAMING.

FULL SCANTLING SINGLE DECK VESSELS—FLUSH DECK.

TABLE 2

(SEE CONTINUATION.)

D	FRAME SPACING.	TYPE OF FRAMING.	FRAMING IN PEAKS.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO DECK AT SIDE.				
				Metres. 6,1	Metres. 6,4	Metres. 6,7	Metres. 7,0	Metres. 7,3
Metres.	mm.		mm.	mm.	mm.	mm.	mm.	mm.
7,3	635	Frames	100 × 75 × 8	150 × 75 × 10,5	150 × 75 × 10,5	150 × 75 × 11	150 × 75 × 11	
		Reversed frames	75 × 75 × 8,5	130 × 75 × 11	140 × 75 × 11	140 × 90 × 11,5	150 × 90 × 11	
		Depth of framing	115	205	215	215	230	
		Bulb angle frames. ..	150 × 75 × 10	220 × 90 × 13	240 × 90 × 11	250 × 90 × 12	250 × 90 × 13	
7,6	650	Frames	100 × 75 × 8,5		150 × 75 × 11,5	150 × 75 × 11,5	150 × 75 × 12	170 × 75 × 11,5
		Reversed frames	75 × 75 × 9		140 × 75 × 12	140 × 90 × 12	150 × 90 × 12	150 × 90 × 12
		Depth of framing	115		215	215	230	240
		Bulb angle frames	150 × 75 × 11		240 × 90 × 12,5	250 × 90 × 13	270 × 90 × 11,5	270 × 90 × 13,5
7,9	660	Frames	100 × 75 × 9			150 × 90 × 12	170 × 90 × 11,5	170 × 90 × 11,5
		Reversed frames	75 × 75 × 9,5			150 × 90 × 12	150 × 90 × 12	170 × 90 × 11,5
		Depth of framing	115			230	240	255
		Bulb angle frames	170 × 75 × 8			270 × 90 × 11,5	270 × 90 × 13,5	280 × 90 × 12,5
8,25	675	Frames	120 × 75 × 9,5				170 × 90 × 11,5	170 × 90 × 12
		Reversed frames	75 × 75 × 9,5				170 × 90 × 11,5	170 × 90 × 12
		Depth of framing	115				255	255
		Bulb angle frames	170 × 75 × 9				280 × 90 × 12,5	280 × 90 × 14
8,55	685	Frames	120 × 75 × 9					180 × 90 × 12
		Reversed frames	75 × 75 × 9					170 × 90 × 12
		Depth of framing	125					265
		Bulb angle frames	170 × 75 × 11					290 × 90 × 13
8,85	695	Frames	130 × 75 × 9					
		Reversed frames	75 × 75 × 9					
		Depth of framing	140					
		Bulb angle frames	180 × 75 × 10					
9,15	710	Frames	140 × 75 × 9,5					
		Reversed frames	75 × 75 × 9,5					
		Depth of framing	140					
		Bulb angle frames	180 × 75 × 11					

SIDE FRAMING.

FULL SCANTLING SINGLE DECK VESSELS—FLUSH DECK.

TABLE 2 *(CONCLUDED.)*

D	FRAME SPACING.	TYPE OF FRAMING.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO DECK AT SIDE.				
			Metres. 7,6	Metres. 7,9	Metres. 8,25	Metres. 8,55	Metres. 8,85
Metres.	mm.		mm.	mm.	mm.	mm.	mm.
7,3	635	Frames					
		Reversed frames					
		Depth of framing					
		Bulb angle frames					
7,6	650	Frames					
		Reversed frames					
		Depth of framing					
		Bulb angle frames					
7,9	660	Frames	170 × 90 × 12,5				
		Reversed frames	170 × 90 × 12,5				
		Depth of framing	255				
		Bulb angle frames	290 × 90 × 12,5				
8,25	675	Frames	180 × 90 × 12	180 × 90 × 13			
		Reversed frames	170 × 90 × 12	180 × 90 × 13			
		Depth of framing	265	265			
		Bulb angle frames	290 × 90 × 13	300 × 95 × 12,5			
8,55	685	Frames	180 × 90 × 13	200 × 90 × 12,5	200 × 90 × 12,5		
		Reversed frames	180 × 90 × 13	180 × 90 × 13	200 × 90 × 12,5		
		Depth of framing	265	280	290		
		Bulb angle frames	300 × 95 × 12,5	300 × 95 × 15	300 × 95 × 17		
8,85	695	Frames	200 × 90 × 12,5	200 × 90 × 12,5	200 × 90 × 13	200 × 90 × 13,5	
		Reversed frames	180 × 90 × 13	200 × 90 × 12,5	200 × 90 × 13	200 × 90 × 13,5	
		Depth of framing	280	290	305	315	
		Bulb angle or channel frames	300 × 95 × 14,5	300 × 95 × 17	280 × 100 × 100 × 14,5 / 16,5	300 × 100 × 100 × 13 / 17	
9,15	710	Frames		200 × 90 × 13	200 × 90 × 13,5	200 × 90 × 14	225 × 90 × 13,5
		Reversed frames		200 × 90 × 13	200 × 90 × 13,5	200 × 90 × 14	200 × 90 × 13,5
		Depth of framing		305	315	315	330
		Channel frames..		280 × 100 × 100 × 14,5 / 16,5	300 × 100 × 100 × 13 / 17	300 × 100 × 100 × 14 / 17	320 × 100 × 100 × 12,5 / 17,5

SIDE FRAMING.

FULL SCANTLING SINGLE DECK VESSELS WITH 100 PER CENT. SUPERSTRUCTURES.

TABLE 2A
(SEE CONTINUATION.)

D	FRAME SPACING.	TYPE OF FRAMING	FRAMING IN PEAKS.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF BOUBLE BOTTOMS, TO DECK AT SIDE.				
				Metres. 2,45	Metres. 3,05	Metres. 3,65	Metres. 3,95	Metres. 4,25
Metres.	mm.		mm.	mm.	mm.	mm.	mm.	mm.
3,05	535	Frames						
		Reversed frames						
		Depth of framing						
		Angle frames	100 × 65 × 7	100 × 65 × 7	100 × 65 × 8	100 × 75 × 9,5	120 × 75 × 8,5	
3,35	545	Frames				65 × 65 × 6,5	65 × 65 × 7	75 × 65 × 6,5
		Reversed frames				65 × 65 × 6,5	65 × 65 × 7	65 × 65 × 6,5
		Depth of framing				65	65	75
		Angle frames	100 × 65 × 7,5	100 × 65 × 7,5	100 × 75 × 9,5	120 × 75 × 9	120 × 75 × 10	130 × 75 × 9,5
3,65	545	Frames				75 × 65 × 6	75 × 65 × 7	75 × 65 × 7
		Reversed frames				65 × 65 × 6	65 × 65 × 7	75 × 65 × 7
		Depth of framing				75	75	90
		Angle frames	100 × 65 × 8,5		120 × 75 × 8,5	130 × 75 × 9	130 × 75 × 10	140 × 75 × 10
3,95	560	Frames			65 × 65 × 7	75 × 65 × 7	75 × 65 × 7	75 × 75 × 6,5
		Reversed frames			65 × 65 × 7	65 × 65 × 7	75 × 65 × 7	75 × 75 × 6,5
		Depth of framing			65	75	90	90
		Angle frames	120 × 75 × 8,5		120 × 75 × 10	130 × 75 × 10	140 × 75 × 10	150 × 75 × 10
4,25	560	Frames	75 × 65 × 6,5			75 × 65 × 7	75 × 75 × 6,5	75 × 75 × 7,5
		Reversed frames	65 × 65 × 6,5			75 × 65 × 7	75 × 75 × 6,5	75 × 75 × 7,5
		Depth of framing	75			90	90	90
		Angle frames	130 × 75 × 9,5			140 × 75 × 10	150 × 75 × 10	170 × 75 × 9,5
4,55	570	Frames	90 × 65 × 6,5			75 × 75 × 6,5	75 × 75 × 7,5	75 × 75 × 8,5
		Reversed frames	65 × 65 × 6,5			75 × 75 × 6,5	75 × 75 × 7,5	75 × 75 × 8,5
		Depth of framing	90			90	90	90
		Angle or bulb angle frames	140 × 75 × 9			150 × 75 × 10	170 × 75 × 9,5	140 × 75 × 8
4,9	570	Frames	90 × 65 × 6,5				75 × 75 × 8,5	90 × 75 × 8
		Reversed frames	75 × 65 × 6,5				75 × 75 × 8,5	75 × 75 × 8
		Depth of framing	100				90	100
		Angle or bulb angle frames	150 × 75 × 9,5				140 × 75 × 8	140 × 75 × 10

SIDE FRAMING.

FULL SCANTLING SINGLE DECK VESSELS WITH 100 PER CENT. SUPERSTRUCTURES.

TABLE 2A

(SEE CONTINUATION.)

D	FRAME SPACING.	TYPE OF FRAMING.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO DECK AT SIDE.					
			Metres. 4,55	Metres. 4,9	Metres. 5,2	Metres. 5,5	Metres. 5,8	Metres. 6,1
Metres	mm.		mm.	mm.	mm.	mm.	mm.	mm.
3,05	535	Frames						
		Reversed frames						
		Depth of framing						
		Angle frames						
3,35	545	Frames						
		Reversed frames						
		Depth of framing						
		Angle frames						
3,65	545	Frames	75 × 65 × 7,5					
		Reversed frames	75 × 65 × 7,5					
		Depth of framing	90					
		Angle frames	140 × 75 × 10,5					
3,95	560	Frames	75 × 75 × 7,5	75 × 75 × 8				
		Reversed frames	75 × 75 × 7,5	75 × 75 × 8				
		Depth of framing	90	90				
		Angle or bulb angle frames	170 × 75 × 9,5	140 × 75 × 7				
4,25	560	Frames	75 × 75 × 8,5	90 × 75 × 8	90 × 75 × 9			
		Reversed frames	75 × 75 × 8,5	75 × 75 × 8	75 × 75 × 9			
		Depth of framing	90	100	100			
		Bulb angle frames	140 × 75 × 8	140 × 75 × 10	150 × 75 × 9			
4,55	570	Frames	90 × 75 × 8	90 × 75 × 8	90 × 75 × 9	100 × 75 × 8,5		
		Reversed frames	75 × 75 × 8	90 × 75 × 8	90 × 75 × 9	90 × 75 × 9		
		Depth of framing	100	115	115	125		
		Bulb angle frames	140 × 75 × 10	150 × 75 × 10	170 × 75 × 8	170 × 75 × 9,5		
4,9	570	Frames	90 × 75 × 8	90 × 75 × 9	100 × 75 × 8,5	100 × 75 × 9	120 × 75 × 10	
		Reversed frames	90 × 75 × 8	90 × 75 × 9	90 × 75 × 9	100 × 75 × 9	100 × 75 × 10,5	
		Depth of framing	115	115	125	140	140	
		Bulb angle frames	150 × 75 × 10	170 × 75 × 8	170 × 75 × 9,5	180 × 75 × 9	190 × 75 × 9	

SIDE FRAMING.

FULL SCANTLING SINGLE DECK VESSELS WITH 100 PER CENT. SUPERSTRUCTURES.

TABLE 2A

(SEE CONTINUATION.)

D	FRAME SPACING.	TYPE OF FRAMING.	FRAMING IN PEAKS.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO DECK AT SIDE.					
				Metres. 4,25	Metres. 4,55	Metres. 4,9	Metres. 5,2	Metres. 5,5	Metres. 5,8
Metres.	mm.		mm.	mm.	mm.	mm.	mm.	mm.	mm.
5,2	585	Frames	90 × 65 × 7	90 × 75 × 8	90 × 75 × 9	100 × 75 × 8,5	100 × 75 × 9	120 × 75 × 9,5	130 × 75 × 9,5
		Reversed frames	75 × 65 × 7	90 × 75 × 8	90 × 75 × 9	90 × 75 × 9	100 × 75 × 9	100 × 75 × 10	100 × 75 × 10
		Depth of framing	100	115	115	125	140	140	150
		Angle or bulb angle frames	170 × 75 × 9	150 × 75 × 10	170 × 75 × 8	170 × 75 × 9,5	180 × 75 × 9	180 × 75 × 11	190 × 75 × 10
5,5	585	Frames	90 × 75 × 7,5		100 × 75 × 8,5	100 × 75 × 9	120 × 75 × 9,5	130 × 75 × 9,5	130 × 75 × 10,5
		Reversed frames	75 × 75 × 7,5		100 × 75 × 8,5	100 × 75 × 9	100 × 75 × 10	100 × 75 × 10	100 × 75 × 11
		Depth of framing	100		140	140	140	150	150
		Bulb angle frames	140 × 75 × 8,5		170 × 75 × 11,5	180 × 75 × 9	180 × 75 × 11	190 × 75 × 10	200 × 75 × 10
5,8	595	Frames	90 × 75 × 8			120 × 75 × 9	130 × 75 × 9,5	130 × 75 × 10,5	130 × 75 × 10,5
		Reversed frames	75 × 75 × 8			100 × 75 × 9,5	100 × 75 × 10	100 × 75 × 11	120 × 75 × 10,5
		Depth of framing	100			150	150	150	165
		Bulb angle frames	140 × 75 × 10			190 × 75 × 9	190 × 75 × 9	200 × 75 × 10	200 × 75 × 11,5
6,1	595	Frames	90 × 75 × 8,5				130 × 75 × 9,5	130 × 75 × 10,5	130 × 75 × 10,5
		Reversed frames	75 × 75 × 8,5				120 × 75 × 9,5	120 × 75 × 9,5	130 × 75 × 10,5
		Depth of framing	100				165	165	180
		Bulb angle frames	150 × 75 × 8				200 × 75 × 10	200 × 75 × 11,5	220 × 75 × 10,5
6,4	610	Frames	100 × 75 × 8					130 × 75 × 11	140 × 75 × 10,5
		Reversed frames	75 × 75 × 8,5					130 × 75 × 11	130 × 75 × 10,5
		Depth of framing	115					180	190
		Bulb angle frames	150 × 75 × 10					220 × 75 × 11,5	220 × 75 × 13
6,7	610	Frames	100 × 75 × 8,5						140 × 75 × 11
		Reversed frames	75 × 75 × 9						140 × 75 × 11
		Depth of framing	115						205
		Bulb angle frames	150 × 75 × 11						220 × 75 × 14
7,0	620	Frames	140 × 75 × 8,5						150 × 75 × 10,5
		Reversed frames	75 × 75 × 8,5						140 × 75 × 11
		Depth of framing	125						215
		Bulb angle frames	170 × 75 × 9,5						240 × 90 × 11

SIDE FRAMING.

FULL SCANTLING SINGLE DECK VESSELS WITH 100 PER CENT. SUPERSTRUCTURES.

TABLE 2A

(SEE CONTINUATION.)

D	FRAME SPACING.	TYPE OF FRAMING.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO DECK AT SIDE.						
			Metres. 6,1	Metres. 6,4	Metres. 6,7	Metres. 7,0	Metres. 7,3	Metres. 7,6	Metres. 7,9
Metres.	mm.		mm.	mm.	mm.	mm.	mm.	mm.	mm.
5,2	585	Frames	130 × 75 × 9,5						
		Reversed frames	120 × 75 × 9,5						
		Depth of framing	165						
		Bulb angle frames	200 × 75 × 10						
5,5	585	Frames	130 × 75 × 10,5	130 × 75 × 10,5					
		Reversed frames	120 × 75 × 10,5	130 × 75 × 10,5					
		Depth of framing	165	180					
		Bulb angle frames	200 × 75 × 11,5	220 × 75 × 10,5					
5,8	595	Frames	140 × 75 × 10	140 × 75 × 10	140 × 75 × 11				
		Reversed frames	140 × 75 × 10	130 × 75 × 10	130 × 75 × 11				
		Depth of framing	180	190	190				
		Bulb angle frames	200 × 75 × 13,5	220 × 75 × 12	220 × 75 × 12				
6,1	595	Frames	140 × 75 × 10	140 × 75 × 11	140 × 75 × 11	150 × 75 × 10			
		Reversed frames	130 × 75 × 10	130 × 75 × 11	140 × 75 × 11	140 × 90 × 10,5			
		Depth of framing	190	190	205	215			
		Bulb angle frames	220 × 75 × 12	220 × 75 × 12	220 × 75 × 14	240 × 90 × 12			
6,4	610	Frames	140 × 75 × 10	140 × 75 × 11	150 × 75 × 10	150 × 75 × 10,5	170 × 75 × 10,5		
		Reversed frames	140 × 75 × 10	140 × 75 × 11	140 × 90 × 10,5	150 × 90 × 10,5	150 × 90 × 11		
		Depth of framing	205	205	215	230	240		
		Bulb angle frames	220 × 75 × 12	220 × 75 × 14	240 × 90 × 12	250 × 90 × 12	270 × 90 × 11,5		
6,7	610	Frames	150 × 75 × 9,5	150 × 75 × 10	150 × 75 × 10	150 × 75 × 11	170 × 75 × 11	170 × 75 × 11	
		Reversed frames	140 × 75 × 10	140 × 90 × 10,5	150 × 90 × 10,5	150 × 90 × 11	150 × 90 × 11,5	170 × 75 × 11	
		Depth of framing	215	215	230	230	240	255	
		Bulb angle frames	240 × 90 × 11	240 × 90 × 12	250 × 90 × 12	250 × 90 × 13	270 × 90 × 12	270 × 90 × 14,5	
7,0	620	Frames	150 × 75 × 10,5	150 × 75 × 11	170 × 75 × 10,5				
		Reversed frames	140 × 90 × 11	150 × 90 × 11	150 × 90 × 11				
		Depth of framing	215	230	240				
		Bulb angle frames	240 × 90 × 13	250 × 90 × 13	270 × 90 × 11,5				

SIDE FRAMING.

FULL SCANTLING SINGLE DECK VESSELS WITH 100 PER CENT. SUPERSTRUCTURES.

TABLE 2A

(SEE CONTINUATION.)

D	FRAME SPACING.	TYPE OF FRAMING.	FRAMING IN PEAKS.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO DECK AT SIDE.				
				Metres. 6,1	Metres. 6,4	Metres. 6,7	Metres. 7,0	Metres. 7,3
Metres.	mm.		mm.	mm.	mm.	mm.	mm.	mm.
7,3	635	Frames	120 × 75 × 9	150 × 75 × 11	170 × 75 × 10,5	170 × 75 × 10,5	170 × 75 × 11,5	
		Reversed frames	75 × 75 × 9	150 × 90 × 11	150 × 9 × 11	170 × 90 × 10,5	170 × 90 × 11,5	
		Depth of framing	125	230	240	255	255	
		Bulb angle frames	170 × 75 × 11	250 × 90 × 13	270 × 90 × 11,5	270 × 90 × 13	280 × 90 × 12,5	
7,6	650	Frames	130 × 75 × 8,5		170 × 75 × 10,5	170 × 75 × 11,5	180 × 75 × 11,5	180 × 75 × 11,5
		Reversed frames	75 × 75 × 8,5		170 × 90 × 10,5	170 × 75 × 11,5	170 × 90 × 11,5	180 × 90 × 11,5
		Depth of framing	140		255	255	265	280
		Bulb angle frames	180 × 75 × 9		270 × 90 × 13	280 × 90 × 12,5	290 × 90 × 12,5	290 × 90 × 14
7,9	660	Frames	130 × 75 × 9			180 × 90 × 11	180 × 90 × 11	180 × 90 × 12
		Reversed frames	75 × 75 × 9			170 × 90 × 11	180 × 90 × 11	180 × 90 × 12
		Depth of framing	140			265	280	280
		Bulb angle frames	180 × 75 × 10			280 × 90 × 13,5	290 × 90 × 13	290 × 90 × 15,5
8,25	675	Frames	130 × 75 × 9,5				180 × 90 × 12	200 × 90 × 11,5
		Reversed frames	90 × 75 × 9,5				180 × 90 × 12	180 × 90 × 12
		Depth of framing	140				280	290
		Bulb angle frames	180 × 75 × 11				290 × 90 × 15,5	300 × 95 × 14,5
8,55	685	Frames	140 × 90 × 9					200 × 90 × 12
		Reversed frames	75 × 75 × 9					180 × 90 × 12,5
		Depth of framing	150					305
		Bulb angle frames	170 × 90 × 9					300 × 95 × 17
8,85	695	Frames	140 × 90 × 9,5					
		Reversed frames	90 × 75 × 9,5					
		Depth of framing	150					
		Bulb angle frames	170 × 90 × 10					
9,15	710	Frames	140 × 90 × 10					
		Reversed frames	90 × 75 × 10					
		Depth of framing	150					
		Bulb angle frames	170 × 90 × 11					

SIDE FRAMING.

FULL SCANTLING SINGLE DECK VESSELS WITH 100 PER CENT. SUPERSTRUCTURES.

TABLE 2A (CONCLUDED.)

D	FRAME SPACING.	TYPE OF FRAMING.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO DECK AT SIDE.				
			Metres. 7,6	Metres. 7,9	Metres. 8,25	Metres. 8,55	Metres. 8,85
Metres.	mm.		mm.	mm.	mm.	mm.	mm.
7,3	635	Frames					
		Reversed frames					
		Depth of framing					
		Bulb angle frames					
7,6	650	Frames					
		Reversed frames					
		Depth of framing					
		Bulb angle frames					
7,9	660	Frames	$200 \times 90 \times 11,5$				
		Reversed frames	$180 \times 90 \times 12$				
		Depth of framing	290				
		Bulb angle frames	$300 \times 95 \times 14,5$				
8,25	675	Frames	$200 \times 90 \times 12$	$200 \times 90 \times 12$			
		Reversed frames	$180 \times 90 \times 12,5$	$200 \times 90 \times 12$			
		Depth of framing	305	315			
		Bulb angle or channel frames	$300 \times 95 \times 17$	$280 \times 100 \times 100 \times \frac{14}{16,5}$			
8,55	685	Frames	$200 \times 90 \times 12$	$200 \times 90 \times 12,5$	$225 \times 90 \times 12$		
		Reversed frames	$200 \times 90 \times 12$	$200 \times 90 \times 12,5$	$200 \times 90 \times 12$		
		Depth of framing	315	330	345		
		Channel frames..	$280 \times 100 \times 100 \times \frac{14}{16,5}$	$300 \times 100 \times 100 \times \frac{12,5}{17}$	$300 \times 100 \times 100 \times \frac{14,5}{17}$		
8,85	695	Frames	$200 \times 90 \times 12,5$	$225 \times 90 \times 12$	$230 \times 100 \times 12$	$230 \times 100 \times 12,5$	
		Reversed frames	$200 \times 90 \times 12,5$	$200 \times 90 \times 12$	$200 \times 90 \times 12,5$	$225 \times 90 \times 13$	
		Depth of framing	330	345	355	355	
		Channel frames..	$300 \times 100 \times 100 \times \frac{12,5}{17}$	$300 \times 100 \times 100 \times \frac{14,5}{17}$	$320 \times 100 \times 100 \times \frac{12,5}{17,5}$	$320 \times 100 \times 100 \times \frac{12,5}{17,5}$	
9,15	710	Frames		$230 \times 100 \times 12$	$230 \times 100 \times 12,5$	$230 \times 100 \times 13$	$230 \times 100 \times 14$
		Reversed frames		$200 \times 90 \times 12,5$	$225 \times 90 \times 13$	$225 \times 90 \times 13,5$	$225 \times 90 \times 14,5$
		Depth of framing		355	355	355	355
		Channel frames..		$320 \times 100 \times 100 \times \frac{12,5}{17,5}$	$320 \times 100 \times 100 \times \frac{14,5}{17,5}$	$320 \times 100 \times 100 \times \frac{15,5}{17,5}$	$340 \times 100 \times 100 \times \frac{14,5}{18}$

SIDE FRAMING.

FULL SCANTLING VESSELS—FLUSH DECK.

TABLE 3

(SEE CONTINUATION.)

D	FRAME SPACING.	TYPE OF FRAMING.	FRAMING IN PEAKS.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO LOWEST DECK AT SIDE.				
				Metres. 2,45	Metres. 3,05	Metres. 3,65	Metres. 3,95	Metres. 4,25
Metres.	mm.		mm.	mm.	mm.	mm.	mm.	mm.
5,5	585	Frames	90×65× 6,5	90×75× 7,5	90×75× 7,5			
		Reversed frames	75×65× 6,5	75×65× 7,5	75×75× 7,5			
		Depth of framing	100	100	100			
		Angle or bulb angle frames	150×75×10	130×75× 9	140×75× 8,5			
5,8	595	Frames	90×75× 7	90×75× 7,5	90×75× 8	90×75× 8		
		Reversed frames	75×65× 7	75×75× 7,5	75×75× 8	90×75× 8		
		Depth of framing	100	100	100	115		
		Angle or bulb angle frames	170×75× 8,5	140×75× 8,5	140×75×10	150×75×10		
6,1	595	Frames	90×75× 7,5	90×75× 8	90×75× 7,5	100×75× 7,5	100×75× 8,5	
		Reversed frames	75×65× 7,5	75×75× 8	90×75× 7,5	90×75× 8	90×75× 9	
		Depth of framing	100	100	115	125	125	
		Angle or bulb angle frames	170×75× 9	140×75×10	150×75× 8,5	150×75×11,5	170×75× 9,5	
6,4	610	Frames	90×75× 7,5	90×75× 7,5	90×75× 8	100×75× 8	100×75× 9	100×75× 9
		Reversed frames	75×75× 7,5	90×75× 7,5	90×75× 8	90×75× 8,5	90×75× 9,5	100×75× 9
		Depth of framing	100	115	115	125	125	140
		Bulb angle frames	140×75× 8,5	150×75× 8,5	150×75×10	170×75× 8,5	170×75×11	180×75× 9
6,7	610	Frames	90×75× 8	90×75× 8	90×75× 9	100×75× 9	100×75× 9	120×75× 8
		Reversed frames	75×75× 8	90×75× 8	90×75× 9	90×75× 9,5	100×75× 9	100×75× 8,5
		Depth of framing	100	115	115	125	140	150
		Bulb angle frames	140×75× 10	150×75×10	170×75× 8	170×75×11	180×75× 9	180×75×10
7,0	620	Frames	90×75× 8,5	90×75× 9	100×75× 8,5	100×75× 9	100×75× 9,5	120×75× 9
		Reversed frames	75×75× 8,5	90×75× 9	90×75× 9	100×75× 9	100×75× 9,5	100×75× 9,5
		Depth of framing	100	115	125	140	140	150
		Bulb angle frames	150×75× 8	170×75× 8	170×75× 9,5	180×75× 9	180×75×10	190×75× 9
7,3	635	Frames	100×75× 8	100×75× 8,5	100×75× 9	100×75× 9,5	120×75× 8,5	120×75× 9
		Reversed frames	75×75× 8	90×75× 9	90×75× 9,5	100×75× 9,5	100×75× 9	100×75× 9,5
		Depth of framing	115	125	125	140	150	150
		Bulb angle frames	150×75×10	170×75× 9,5	170×75×11	180×75×10	180×75×11,5	190×75× 9
7,6	650	Frames	100×75× 8,5	100×75× 9	120×75× 8,5	120×75× 8,5	120×75× 9	120×75× 9
		Reversed frames	75×75× 9	90×75× 9,5	90×75× 9	100×75× 9	100×75× 9,5	120×75× 9
		Depth of framing	115	125	140	150	150	165
		Bulb angle frames	150×75×11	170×75×11	180×75× 9	180×75×11,5	190×75× 9	190×75×11,5
7,9	660	Frames	100×75× 9	120×90× 8,5	120×90× 9	120×90× 9	120×90× 9,5	130×90× 9,5
		Reversed frames	75×75× 9,5	75×90× 8,5	75×90× 9	90×90× 9	100×90× 9,5	100×90× 9,5
		Depth of framing	115	125	125	140	140	150
		Bulb angle frames	170×75× 8	180×85× 9,5	180×85×10,5	190×85× 9,5	190×85×10,5	200×85×10
8,25	675	Frames	120×75× 8,5	120×90× 9	120×90× 9	120×90× 9,5	120×90×10,5	130×90×10
		Reversed frames	75×75× 8,5	75×90× 9	90×90× 9	100×90× 9,5	100×90×10,5	100×90×10
		Depth of framing	125	125	140	140	140	150
		Bulb angle frames	170×75× 9,5	180×85×10,5	190×85× 9,5	190×85×10,5	190×85×12,5	200×85×11

SIDE FRAMING.

FULL SCANTLING VESSELS—FLUSH DECK.

TABLE 3

(SEE CONTINUATION.)

D	FRAME SPACING.	TYPE OF FRAMING.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO LOWEST DECK AT SIDE.					
			Metres. 4,55	Metres. 4,9	Metres. 5,2	Metres. 5,5	Metres. 5,8	Metres. 6,1
Metres.	mm.		mm.	mm.	mm.	mm.	mm.	mm.
5,5	585	Frames						
		Reversed frames						
		Depth of framing						
		Bulb angle frames						
5,8	595	Frames						
		Reversed frames						
		Depth of framing..						
		Bulb angle frames						
6,1	595	Frames						
		Reversed frames						
		Depth of framing..						
		Bulb angle frames						
6,4	610	Frames						
		Reversed frames						
		Depth of framing..						
		Bulb angle frames						
6,7	610	Frames	120 × 75 × 9					
		Reversed frames	100 × 75 × 9,5					
		Depth of framing..	150					
		Bulb angle frames	190 × 75 × 9					
7,0	620	Frames	120 × 75 × 9	120 × 75 × 9				
		Reversed frames	100 × 75 × 9,5	120 × 75 × 9				
		Depth of framing..	150	165				
		Bulb angle frames	190 × 75 × 9	190 × 75 × 11,5				
7,3	635	Frames	120 × 75 × 9	130 × 75 × 9	130 × 75 × 9			
		Reversed frames	120 × 75 × 9	120 × 75 × 9	130 × 75 × 9			
		Depth of framing..	165	180	190			
		Bulb angle frames	190 × 75 × 11,5	200 × 75 × 11	220 × 75 × 9,5			
7,6	650	Frames	130 × 75 × 10	130 × 75 × 9,5	140 × 75 × 9,5	140 × 75 × 10,5		
		Reversed frames	120 × 75 × 10	130 × 75 × 9,5	130 × 75 × 9,5	130 × 75 × 10,5		
		Depth of framing..	165	180	190	190		
		Bulb angle frames	200 × 75 × 10,5	200 × 75 × 12	220 × 75 × 11	220 × 75 × 13		
7,9	660	Frames	130 × 90 × 10	130 × 90 × 10	130 × 90 × 10	140 × 90 × 10	140 × 90 × 11	
		Reversed frames	100 × 90 × 10	120 × 90 × 10	130 × 90 × 10	130 × 90 × 10	130 × 90 × 11	
		Depth of framing..	150	165	180	190	190	
		Bulb angle frames	200 × 85 × 11	200 × 85 × 13	220 × 85 × 12	230 × 90 × 11	230 × 90 × 13	
8,25	675	Frames	130 × 90 × 10	130 × 90 × 10	130 × 90 × 11	140 × 90 × 11	140 × 90 × 11	150 × 90 × 11
		Reversed frames	120 × 90 × 10	130 × 90 × 10	130 × 90 × 11	130 × 90 × 11	140 × 90 × 11	140 × 90 × 11,5
		Depth of framing..	165	180	180	190	205	215
		Bulb angle frames	200 × 85 × 13	220 × 85 × 12	230 × 90 × 10,5	230 × 90 × 13	240 × 90 × 12	250 × 90 × 12

SIDE FRAMING.

FULL SCANTLING VESSELS—FLUSH DECK.

TABLE 3

(SEE CONTINUATION.)

D	FRAME SPACING.	TYPE OF FRAMING.	FRAMING IN PEAKS.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO LOWEST DECK AT SIDE.			
				Metres. 2,45	Metres. 3,05	Metres. 3,65	Metres. 3,95
Metres.	mm.		mm.	mm.	mm.	mm.	mm.
8,55	685	Frames	120 × 75 × 9	130 × 90 × 9	130 × 90 × 9,5	130 × 90 × 10,5	130 × 90 × 10
		Reversed frames	75 × 75 × 9	75 × 90 × 9	90 × 90 × 9,5	90 × 90 × 10,5	100 × 90 × 10
		Depth of framing	125	140	140	140	150
		Bulb angle frames	170 × 75 × 11	190 × 85 × 9,5	190 × 85 × 10,5	190 × 85 × 12,5	200 × 85 × 11
8,85	695	Frames	130 × 75 × 9	130 × 90 × 9,5	130 × 90 × 10	130 × 90 × 10	130 × 90 × 10,5
		Reversed frames	75 × 75 × 9	90 × 90 × 9,5	90 × 90 × 10	100 × 90 × 10	100 × 90 × 10,5
		Depth of framing	140	140	140	150	150
		Bulb angle frames	180 × 75 × 10	190 × 85 × 10,5	190 × 85 × 11,5	200 × 85 × 11	200 × 85 × 12
9,15	710	Frames	140 × 75 × 9,5	130 × 90 × 10,5	130 × 90 × 9,5	130 × 90 × 10,5	130 × 90 × 10
		Reversed frames	75 × 75 × 9,5	90 × 90 × 10,5	100 × 90 × 9,5	100 × 90 × 10,5	120 × 90 × 10
		Depth of framing	140	140	150	150	165
		Bulb angle frames	180 × 75 × 11	190 × 85 × 12,5	190 × 85 × 13	200 × 85 × 12	200 × 85 × 13
9,45	725	Frames	140 × 75 × 10	140 × 90 × 10	140 × 90 × 10,5	140 × 90 × 10	140 × 90 × 10,5
		Reversed frames	75 × 75 × 10	90 × 90 × 10	90 × 90 × 10,5	100 × 90 × 10	100 × 90 × 10,5
		Depth of framing	140	150	150	165	165
		Bulb angle frames	190 × 75 × 9	200 × 85 × 11	200 × 85 × 12	200 × 85 × 13	220 × 85 × 10,5
9,75	735	Frames	140 × 75 × 10,5	140 × 90 × 10,5	140 × 90 × 11	140 × 90 × 10,5	140 × 90 × 10
		Reversed frames	75 × 75 × 10,5	90 × 90 × 10,5	90 × 90 × 11	100 × 90 × 10,5	120 × 90 × 10
		Depth of framing	140	150	150	165	180
		Bulb angle frames	190 × 75 × 9,5	200 × 85 × 12	200 × 85 × 13	220 × 85 × 10,5	220 × 85 × 12
10,0	750	Frames	150 × 75 × 10	150 × 90 × 10	150 × 90 × 10,5	150 × 90 × 10	150 × 90 × 10,5
		Reversed frames	75 × 75 × 10,5	90 × 90 × 10,5	90 × 90 × 11	100 × 90 × 10,5	100 × 90 × 11
		Depth of framing	150	165	165	180	180
		Bulb angle frames	190 × 75 × 11	200 × 90 × 13	220 × 85 × 11	220 × 90 × 12	220 × 90 × 13
10,35	760	Frames	150 × 75 × 10	150 × 90 × 10	150 × 90 × 10,5	150 × 90 × 10	150 × 90 × 10,5
		Reversed frames	90 × 75 × 10,5	100 × 90 × 10,5	100 × 90 × 11	120 × 90 × 10,5	120 × 90 × 11
		Depth of framing	165	180	180	190	190
		Bulb angle frames	200 × 75 × 10,5	220 × 90 × 12	220 × 90 × 13	230 × 90 × 11	230 × 90 × 12
10,65	775	Frames	170 × 75 × 10	170 × 90 × 10,5	170 × 90 × 10	170 × 90 × 10,5	170 × 90 × 10
		Reversed frames	90 × 75 × 10	90 × 90 × 10,5	100 × 90 × 10	100 × 90 × 10,5	120 × 90 × 10
		Depth of framing	180	180	190	190	205
		Bulb angle frames	220 × 75 × 10	220 × 90 × 13	230 × 90 × 11	230 × 90 × 12	240 × 90 × 10,5
10,95	785	Frames	170 × 90 × 10,5	170 × 90 × 10	170 × 90 × 10,5	170 × 90 × 10	170 × 90 × 11
		Reversed frames	90 × 90 × 10,5	100 × 90 × 10	100 × 90 × 10,5	120 × 90 × 10	120 × 90 × 11
		Depth of framing	180	190	190	205	205
		Bulb angle frames	230 × 90 × 10	230 × 90 × 11	230 × 90 × 12	240 × 90 × 10,5	240 × 90 × 12
11,3	800	Frames	180 × 90 × 10	180 × 90 × 10	180 × 90 × 10,5	180 × 90 × 11	180 × 90 × 11,5
		Reversed frames	90 × 90 × 10	100 × 90 × 10	100 × 90 × 10,5	100 × 90 × 11	100 × 90 × 11,5
		Depth of framing	190	205	205	205	205
		Bulb angle frames	230 × 90 × 11	240 × 90 × 10,5	240 × 90 × 11,5	240 × 90 × 12	240 × 90 × 13

SIDE FRAMING.

FULL SCANTLING VESSELS—FLUSH DECK.

TABLE 3

(SEE CONTINUATION.)

D	FRAME SPACING.	TYPE OF FRAMING.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO LOWEST DECK AT SIDE.				
			Metres. 4,25	Metres. 4,55	Metres. 4,9	Metres. 5,2	Metres. 5,5
Metres.	mm.		mm.	mm.	mm.	mm.	mm.
8,55	685	Frames	130 × 90 × 10,5	130 × 90 × 10,5	130 × 90 × 10,5	140 × 90 × 10,5	140 × 90 × 11,5
		Reversed frames	100 × 90 × 10,5	120 × 90 × 10,5	130 × 90 × 10,5	130 × 90 × 10,5	130 × 90 × 11,5
		Depth of framing	150	165	180	190	190
		Bulb angle frames	200 × 85 × 12	220 × 85 × 10,5	220 × 85 × 13	230 × 90 × 12	240 × 90 × 11
8,85	695	Frames	130 × 90 × 10	130 × 90 × 10	130 × 90 × 11	140 × 90 × 11	140 × 90 × 11
		Reversed frames	120 × 90 × 10	130 × 90 × 10	130 × 90 × 11	130 × 90 × 11	140 × 90 × 11
		Depth of framing	165	180	180	190	205
		Bulb angle frames	200 × 85 × 13	220 × 85 × 12	230 × 90 × 10,5	230 × 90 × 13	240 × 90 × 12
9,15	710	Frames	130 × 90 × 9,5	130 × 90 × 10,5	140 × 90 × 10,5	140 × 90 × 11,5	140 × 90 × 11,5
		Reversed frames	130 × 90 × 9,5	130 × 90 × 10,5	130 × 90 × 10,5	130 × 90 × 11,5	140 × 90 × 11,5
		Depth of framing	180	180	190	190	205
		Bulb angle frames	220 × 85 × 10,5	220 × 85 × 13	230 × 90 × 12	240 × 90 × 11	240 × 90 × 13
9,45	725	Frames	140 × 90 × 10	140 × 90 × 10	140 × 90 × 11	150 × 90 × 11	150 × 90 × 11
		Reversed frames	120 × 90 × 10	130 × 90 × 10	130 × 90 × 11	130 × 90 × 11,5	140 × 90 × 11,5
		Depth of framing	180	190	190	205	215
		Bulb angle frames	220 × 85 × 12	230 × 90 × 11	230 × 90 × 13	240 × 90 × 12	250 × 90 × 12
9,75	735	Frames	140 × 90 × 11	140 × 90 × 10,5	140 × 90 × 11,5	150 × 90 × 11,5	150 × 90 × 11,5
		Reversed frames	120 × 90 × 11	130 × 90 × 10,5	130 × 90 × 11,5	130 × 90 × 12	150 × 90 × 11,5
		Depth of framing	180	190	190	205	230
		Bulb angle frames	230 × 90 × 10,5	230 × 90 × 12	240 × 90 × 11	240 × 90 × 13	250 × 90 × 14
10,0	750	Frames	150 × 90 × 10,5	150 × 90 × 10,5	150 × 90 × 11,5	150 × 90 × 11,5	150 × 90 × 12
		Reversed frames	120 × 90 × 11	130 × 90 × 11	130 × 90 × 12	140 × 90 × 12	150 × 90 × 12
		Depth of framing	190	205	205	215	230
		Bulb angle frames	230 × 90 × 12	240 × 90 × 11,5	240 × 90 × 13	250 × 90 × 13	270 × 90 × 11,5
10,35	760	Frames	150 × 90 × 10	150 × 90 × 11	150 × 90 × 12	150 × 90 × 12	150 × 90 × 12,5
		Reversed frames	130 × 90 × 10,5	130 × 90 × 11,5	130 × 90 × 12,5	140 × 90 × 12,5	150 × 90 × 12,5
		Depth of framing	205	205	205	215	230
		Bulb angle frames	240 × 90 × 10,5	240 × 90 × 12	250 × 90 × 12	250 × 90 × 14	270 × 90 × 12,5
10,65	775	Frames	170 × 90 × 10,5	170 × 90 × 11,5	170 × 90 × 11,5	170 × 90 × 11,5	170 × 90 × 12
		Reversed frames	120 × 90 × 10,5	120 × 90 × 11,5	130 × 90 × 11,5	140 × 90 × 11,5	150 × 90 × 12,5
		Depth of framing	205	205	215	230	240
		Bulb angle frames	240 × 90 × 11,5	240 × 90 × 13	250 × 90 × 13	270 × 90 × 11,5	270 × 90 × 14,5
10,95	785	Frames	170 × 90 × 11,5	170 × 90 × 11,5	170 × 90 × 12	170 × 90 × 12,5	170 × 90 × 12,5
		Reversed frames	120 × 90 × 11,5	130 × 90 × 11,5	130 × 90 × 12	140 × 90 × 12,5	150 × 90 × 13
		Depth of framing	205	215	215	230	240
		Bulb angle frames	240 × 90 × 13	250 × 90 × 13	250 × 90 × 14	270 × 90 × 13,5	280 × 90 × 12,5
11,3	800	Frames	180 × 90 × 11	180 × 90 × 12	180 × 90 × 12	180 × 90 × 12	180 × 90 × 12
		Reversed frames	120 × 90 × 11	120 × 90 × 12	130 × 90 × 12	140 × 90 × 12	150 × 90 × 12,5
		Depth of framing	215	215	230	240	255
		Bulb angle frames	250 × 90 × 12	250 × 90 × 14	270 × 90 × 12,5	270 × 90 × 14,5	280 × 90 × 14

SIDE FRAMING.

FULL SCANTLING VESSELS—FLUSH DECK.

TABLE 3

(SEE CONTINUATION.)

D	FRAME SPACING.	TYPE OF FRAMING.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO LOWEST DECK AT SIDE.			
			Metres. 5,8	Metres. 6,1	Metres. 6,4	Metres. 6,7
Metres.	mm.		mm.	mm.	mm.	mm.
8,55	685	Frames	140 × 90 × 11,5	150 × 90 × 11,5	150 × 90 × 12	
		Reversed frames	140 × 90 × 11,5	140 × 90 × 12	150 × 90 × 12	
		Depth of framing	205	215	230	
		Bulb angle frames	240 × 90 × 13	250 × 90 × 13	270 × 90 × 11,5	
8,85	695	Frames	150 × 90 × 11	150 × 90 × 12	170 × 90 × 11,5	170 × 90 × 11,5
		Reversed frames	140 × 90 × 11,5	150 × 90 × 12	150 × 90 × 12	170 × 90 × 11,5
		Depth of framing	215	230	240	255
		Bulb angle frames	250 × 90 × 12	270 × 90 × 11,5	270 × 90 × 13,5	280 × 90 × 12,5
9,15	710	Frames	150 × 90 × 11,5	170 × 90 × 11	170 × 90 × 12	170 × 90 × 12
		Reversed frames	150 × 90 × 11,5	150 × 90 × 11,5	150 × 90 × 12,5	170 × 90 × 12
		Depth of framing	230	240	240	255
		Bulb angle frames	250 × 90 × 14	270 × 90 × 12,5	270 × 90 × 14	280 × 90 × 14
9,45	725	Frames	150 × 90 × 12	170 × 90 × 11,5	180 × 90 × 11,5	180 × 90 × 12
		Reversed frames	150 × 90 × 12	150 × 90 × 12	150 × 90 × 12	170 × 90 × 12
		Depth of framing	230	240	255	265
		Bulb angle frames	270 × 90 × 11,5	270 × 90 × 13,5	280 × 90 × 12,5	290 × 90 × 13
9,75	735	Frames	170 × 90 × 11	170 × 90 × 12	180 × 90 × 12	180 × 90 × 12,5
		Reversed frames	150 × 90 × 11,5	150 × 90 × 12,5	150 × 90 × 12,5	170 × 90 × 12,5
		Depth of framing	240	240	255	265
		Bulb angle frames	270 × 90 × 12,5	270 × 90 × 14,5	280 × 90 × 14	290 × 90 × 14,5
10,0	750	Frames	170 × 90 × 11,5	170 × 90 × 11,5	180 × 90 × 12	200 × 90 × 11,5
		Reversed frames	150 × 90 × 12	170 × 90 × 11,5	170 × 90 × 12	170 × 90 × 12
		Depth of framing	240	255	265	280
		Bulb angle frames	270 × 90 × 14	280 × 90 × 12,5	290 × 90 × 13	290 × 90 × 15,5
10,35	760	Frames	170 × 90 × 12	170 × 90 × 12,5	180 × 90 × 12,5	200 × 90 × 12
		Reversed frames	150 × 90 × 12,5	170 × 90 × 12,5	170 × 90 × 12,5	170 × 90 × 12,5
		Depth of framing	240	255	265	280
		Bulb angle frames	270 × 90 × 14,5	290 × 90 × 12,5	290 × 90 × 14,5	300 × 95 × 13,5
10,65	775	Frames	170 × 90 × 12	180 × 90 × 12	180 × 90 × 12,5	200 × 90 × 12
		Reversed frames	170 × 90 × 12	170 × 90 × 12	180 × 90 × 12,5	180 × 90 × 12,5
		Depth of framing	255	265	280	290
		Bulb angle frames	280 × 90 × 14	290 × 90 × 13	300 × 95 × 13,5	300 × 95 × 16
10,95	785	Frames	170 × 90 × 12,5	180 × 90 × 12,5	200 × 90 × 12	200 × 90 × 12,5
		Reversed frames	170 × 90 × 12,5	170 × 90 × 12,5	180 × 90 × 12,5	180 × 90 × 12,5
		Depth of framing	255	255	280	290
		Bulb angle frames	290 × 90 × 12,5	290 × 90 × 14,5	300 × 95 × 14,5	300 × 95 × 17
11,3	800	Frames	180 × 90 × 12,5	180 × 90 × 12,5	200 × 90 × 12,5	200 × 90 × 12,5
		Reversed frames	170 × 90 × 12,5	180 × 90 × 12,5	180 × 90 × 12,5	180 × 90 × 13
		Depth of framing	265	280	290	305
		Bulb angle or channel frames	290 × 90 × 14,5	300 × 95 × 13,5	300 × 95 × 16	280 × 100 × 100 × 13,5 / 16,5

SIDE FRAMING.

FULL SCANTLING VESSELS—FLUSH DECK.

TABLE 3

(SEE CONTINUATION.)

D	FRAME SPACING.	TYPE OF FRAMING.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO LOWEST DECK AT SIDE.			
			Metres. 7,0	Metres. 7,3	Metres. 7,6	Metres. 7,9
Metres.	mm.		mm.	mm.	mm.	mm.
8,55	685	Frames				
		Reversed frames				
		Depth of framing				
		Bulb angle frames				
8,85	695	Frames				
		Reversed frames				
		Depth of framing				
		Bulb angle frames				
9,15	710	Frames	180 × 90 × 12			
		Reversed frames	170 × 90 × 12			
		Depth of framing	265			
		Bulb angle frames	290 × 90 × 13			
9,45	725	Frames	180 × 90 × 12	200 × 90 × 11,5		
		Reversed frames	180 × 90 × 12	180 × 90 × 12		
		Depth of framing	280	290		
		Bulb angle frames	290 × 90 × 15,5	300 × 95 × 14,5		
9,75	735	Frames	180 × 90 × 12,5	200 × 90 × 12	200 × 90 × 13	
		Reversed frames	180 × 90 × 12,5	180 × 90 × 12,5	200 × 90 × 13	
		Depth of framing	280	290	305	
		Bulb angle or channel frames	300 × 95 × 13,5	300 × 90 × 16	280 × 100 × 100 × 14,5 / 16,5	
10,0	750	Frames	200 × 90 × 12	200 × 90 × 12		
		Reversed frames	180 × 90 × 12,5	200 × 90 × 12		
		Depth of framing	290	305		
		Bulb angle or channel frames	300 × 95 × 16	280 × 100 × 100 × 13,5 / 16,5		
10,35	760	Frames	200 × 90 × 12,5	200 × 90 × 13	200 × 90 × 14	
		Reversed frames	200 × 90 × 12,5	200 × 90 × 13	200 × 90 × 14	
		Depth of framing	290	305	315	
		Bulb angle or channel frames	300 × 95 × 17	280 × 100 × 100 × 14,5 / 16,5	300 × 100 × 100 × 14 / 17	
10,65	775	Frames	200 × 90 × 13	200 × 90 × 13,5	225 × 90 × 13	225 × 90 × 12,5
		Reversed frames	200 × 90 × 13	200 × 90 × 13,5	200 × 90 × 13	225 × 90 × 12,5
		Depth of framing	305	315	330	345
		Channel frames	280 × 100 × 100 × 14,5 / 16,5	300 × 100 × 100 × 13 / 17	300 × 100 × 100 × 14,5 / 17	320 × 100 × 100 × 13 / 17,5
10,95	785	Frames	200 × 90 × 13,5	225 × 90 × 13	225 × 90 × 12,5	225 × 90 × 13,5
		Reversed frames	200 × 90 × 13,5	200 × 90 × 13	225 × 90 × 12,5	225 × 90 × 13,5
		Depth of framing	305	330	345	345
		Channel frames	280 × 100 × 100 × 15 / 16,5	300 × 100 × 100 × 14,5 / 17	320 × 100 × 100 × 13 / 17,5	320 × 100 × 100 × 14,5 / 17,5
11,3	800	Frames	225 × 90 × 12,5	225 × 90 × 12,5	225 × 90 × 13,5	230 × 100 × 13,5
		Reversed frames	200 × 90 × 12,5	200 × 90 × 13,5	225 × 90 × 13,5	225 × 90 × 14
		Depth of framing	315	330	345	355
		Channel frames	300 × 100 × 100 × 13,5 / 17	320 × 100 × 100 × 12,5 / 17,5	320 × 100 × 100 × 14,5 / 17,5	340 × 100 × 100 × 13,5 / 18

SIDE FRAMING.

FULL SCANTLING VESSELS—FLUSH DECK.

TABLE 3

(SEE CONTINUATION.)

D	FRAME SPACING.	TYPE OF FRAMING.	FRAMING IN PEAKS.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO LOWEST DECK AT SIDE.			
				Metres. 2,45	Metres. 3,05	Metres. 3,65	Metres. 3,95
Metres.	mm.		mm.	mm.	mm.	mm.	mm.
11,6	815	Frames	180 × 90 × 10,5	180 × 90 × 10,5	180 × 90 × 11	180 × 90 × 11,5	180 × 90 × 11,5
		Reversed frames	90 × 90 × 10,5	100 × 90 × 10,5	100 × 90 × 11	100 × 90 × 11,5	120 × 90 × 11,5
		Depth of framing	190	205	205	205	215
		Bulb angle frames	230 × 90 × 12	240 × 90 × 11,5	240 × 90 × 12	240 × 90 × 13	250 × 90 × 13
11,9	825	Frames	200 × 90 × 10	200 × 90 × 10,5	200 × 90 × 11	200 × 90 × 11	200 × 90 × 10,5
		Reversed frames	90 × 90 × 10,5	90 × 90 × 11	90 × 90 × 11,5	100 × 90 × 11,5	120 × 90 × 11
		Depth of framing	205	205	205	215	230
		Bulb angle frames	240 × 90 × 11,5	240 × 90 × 12	240 × 90 × 13	250 × 90 × 13	250 × 90 × 14
12,2	840	Frames	200 × 90 × 10,5	200 × 90 × 11	200 × 90 × 11,5	200 × 90 × 11	200 × 90 × 11,5
		Reversed frames	90 × 90 × 11	90 × 90 × 11,5	90 × 90 × 12	100 × 90 × 11,5	100 × 90 × 12
		Depth of framing	205	205	215	230	230
		Bulb angle frames	240 × 90 × 12,5	240 × 90 × 13	250 × 90 × 13	250 × 90 × 14	270 × 90 × 11,5
12,5	850	Frames	200 × 90 × 11	200 × 90 × 11	200 × 90 × 11,5	200 × 90 × 11	200 × 90 × 11,5
		Reversed frames	90 × 90 × 11,5	100 × 90 × 11,5	100 × 90 × 12	120 × 90 × 11,5	120 × 90 × 12
		Depth of framing	215	230	230	240	240
		Bulb angle frames	250 × 90 × 12	250 × 90 × 13,5	270 × 90 × 11,5	270 × 90 × 12,5	270 × 90 × 13,5
12,8	865	Frames	200 × 90 × 11	200 × 90 × 11,5	200 × 90 × 12	200 × 90 × 11,5	200 × 90 × 12
		Reversed frames	100 × 90 × 11,5	100 × 90 × 12	100 × 90 × 12,5	120 × 90 × 12	120 × 90 × 12,5
		Depth of framing	230	230	230	240	240
		Bulb angle frames	250 × 90 × 14	270 × 90 × 11,5	270 × 90 × 12,5	270 × 90 × 13,5	270 × 90 × 14,5
13,1	875	Frames	200 × 90 × 11,5	200 × 90 × 11,5	200 × 90 × 12	200 × 90 × 11,5	200 × 90 × 12
		Reversed frames	100 × 90 × 12	120 × 90 × 12	120 × 90 × 12,5	130 × 90 × 12	130 × 90 × 12,5
		Depth of framing	230	240	240	255	255
		Bulb angle frames	270 × 90 × 11,5	270 × 90 × 13,5	270 × 90 × 14,5	280 × 90 × 12,5	280 × 90 × 14
13,4	890	Frames	200 × 90 × 11,5	200 × 90 × 11,5	200 × 90 × 12	200 × 90 × 11,5	200 × 90 × 12
		Reversed frames	120 × 90 × 12	130 × 90 × 12	130 × 90 × 12,5	140 × 90 × 12	140 × 90 × 12,5
		Depth of framing	240	255	255	265	265
		Bulb angle frames	270 × 90 × 13,5	280 × 90 × 12,5	280 × 90 × 14	290 × 90 × 12,5	290 × 90 × 13
13,7	900	Frames	200 × 90 × 11,5	200 × 90 × 12	200 × 90 × 12,5	200 × 90 × 12	200 × 90 × 12,5
		Reversed frames	130 × 90 × 12	130 × 90 × 12,5	130 × 90 × 13	140 × 90 × 12,5	140 × 90 × 13
		Depth of framing	255	255	255	265	265
		Bulb angle frames	280 × 90 × 12,5	280 × 90 × 14	290 × 90 × 12,5	290 × 90 × 13	290 × 90 × 14,5
14,0	915	Frames	200 × 90 × 12	200 × 90 × 12	200 × 90 × 12,5	200 × 90 × 12,5	200 × 90 × 13
		Reversed frames	130 × 90 × 12,5	140 × 90 × 12,5	140 × 90 × 13	150 × 90 × 12,5	150 × 90 × 13
		Depth of framing	255	265	265	280	280
		Bulb angle frames	280 × 90 × 14	290 × 90 × 13	290 × 90 × 14,5	290 × 90 × 15,5	300 × 95 × 13,5

SIDE FRAMING.

FULL SCANTLING VESSELS—FLUSH DECK.

TABLE 3

(SEE CONTINUATION.)

D	FRAME SPACING.	TYPE OF FRAMING.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO LOWEST DECK AT SIDE.				
			Metres. 4,25	Metres. 4,55	Metres. 4,9	Metres. 5,2	Metres. 5,5
Metres.	mm.		mm.	mm.	mm.	mm.	mm.
11,6	815	Frames	180 × 90 × 11	180 × 90 × 12	200 × 90 × 11	200 × 90 × 12	200 × 90 × 12
		Reversed frames	130 × 90 × 11	130 × 90 × 12	130 × 90 × 11,5	130 × 90 × 12,5	140 × 90 × 12,5
		Depth of framing	230	230	240	240	255
		Bulb angle frames	250 × 90 × 14	270 × 90 × 12,5	270 × 90 × 13,5	280 × 90 × 12,5	290 × 90 × 12,5
11,9	825	Frames	200 × 90 × 11	200 × 90 × 11,5	200 × 90 × 12	200 × 90 × 12	200 × 90 × 12
		Reversed frames	120 × 90 × 11,5	120 × 90 × 12	120 × 90 × 12,5	130 × 90 × 12,5	140 × 90 × 12,5
		Depth of framing	230	240	240	255	265
		Bulb angle frames	270 × 90 × 12	270 × 90 × 13,5	270 × 90 × 14,5	280 × 90 × 14	290 × 90 × 13
12,2	840	Frames	200 × 90 × 11	200 × 90 × 12	200 × 90 × 12	200 × 90 × 12	200 × 90 × 12,5
		Reversed frames	120 × 90 × 11,5	120 × 90 × 12,5	130 × 90 × 12,5	140 × 90 × 12,5	150 × 90 × 12,5
		Depth of framing	240	240	255	265	280
		Bulb angle frames	270 × 90 × 12,5	270 × 90 × 14,5	280 × 90 × 14	290 × 90 × 13	290 × 90 × 15,5
12,5	850	Frames	200 × 90 × 11	200 × 90 × 12	200 × 90 × 12,5	200 × 90 × 12,5	200 × 90 × 12
		Reversed frames	130 × 90 × 11,5	130 × 90 × 12,5	130 × 90 × 13	150 × 90 × 12,5	170 × 90 × 12,5
		Depth of framing	255	255	255	280	290
		Bulb angle frames	270 × 90 × 14,5	280 × 90 × 14	290 × 90 × 12,5	290 × 90 × 15,5	300 × 95 × 14,5
12,8	865	Frames	200 × 90 × 11,5	200 × 90 × 12,5	200 × 90 × 12,5	200 × 90 × 13	200 × 90 × 12,5
		Reversed frames	130 × 90 × 12	130 × 90 × 13	140 × 90 × 13	150 × 90 × 13	170 × 90 × 13
		Depth of framing	255	255	265	280	290
		Bulb angle frames	280 × 90 × 12,5	290 × 90 × 12,5	290 × 90 × 14,5	300 × 95 × 13,5	300 × 95 × 16
13,1	875	Frames	200 × 90 × 11,5	200 × 90 × 12,5	200 × 90 × 13	200 × 90 × 12,5	200 × 90 × 12,5
		Reversed frames	140 × 90 × 12	140 × 90 × 13	150 × 90 × 13	170 × 90 × 13	180 × 90 × 13
		Depth of framing	265	265	280	290	305
		Bulb angle or channel frames	290 × 90 × 12,5	290 × 90 × 14,5	300 × 95 × 13,5	300 × 95 × 16	280 × 100 × 100 × 13,5 / 16,5
13,4	890	Frames	200 × 90 × 12	200 × 90 × 13	200 × 90 × 12,5	200 × 90 × 13	200 × 90 × 13
		Reversed frames	150 × 90 × 12	200 × 90 × 13	170 × 90 × 13	180 × 90 × 13,5	200 × 90 × 13
		Depth of framing	280	280	290	290	305
		Bulb angle or channel frames	290 × 90 × 14	300 × 95 × 13,5	300 × 95 × 16	300 × 95 × 17	280 × 100 × 100 × 14,5 / 16,5
13,7	900	Frames	200 × 90 × 12,5	200 × 90 × 12,5	200 × 90 × 12,5	200 × 90 × 13	200 × 90 × 13,5
		Reversed frames	150 × 90 × 12,5	170 × 90 × 13	180 × 90 × 13	200 × 90 × 13	200 × 90 × 13,5
		Depth of framing	280	290	305	305	315
		Bulb angle or channel frames	290 × 90 × 15,5	300 × 95 × 16	280 × 100 × 100 × 13,5 / 16,5	280 × 100 × 100 × 14,5 / 16,5	300 × 100 × 100 × 13 / 17
14,0	915	Frames	200 × 90 × 12	200 × 90 × 12,5	200 × 90 × 12,5	200 × 90 × 13,5	225 × 90 × 13
		Reversed frames	170 × 90 × 12,5	180 × 90 × 13	200 × 90 × 12,5	200 × 90 × 13,5	200 × 90 × 13,5
		Depth of framing	290	305	315	315	330
		Bulb angle or channel frames	300 × 95 × 14,5	280 × 100 × 100 × 13,5 / 16,5	280 × 100 × 100 × 15 / 16,5	300 × 100 × 100 × 13 / 17	300 × 100 × 100 × 14,5 / 17

SIDE FRAMING.

FULL SCANTLING VESSELS—FLUSH DECK.

TABLE 3

(SEE CONTINUATION.)

D	FRAME SPACING.	TYPE OF FRAMING.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO LOWEST DECK AT SIDE.			
			Metres. 5,8	Metres. 6,1	Metres. 6,4	Metres. 6,7
Metres.	mm.		mm.	mm.	mm.	mm.
11,6	815	Frames	$200 \times 90 \times 12,5$	$200 \times 90 \times 12,5$	$200 \times 90 \times 12$	$200 \times 90 \times 12,5$
		Reversed frames	$170 \times 90 \times 13$	$180 \times 90 \times 13$	$200 \times 90 \times 12$	$200 \times 90 \times 12,5$
		Depth of framing	265	280	305	315
		Bulb angle or channel frames	$290 \times 90 \times 15,5$	$300 \times 95 \times 14,5$	$280 \times 100 \times 100 \times \frac{13,5}{16,5}$	$280 \times 100 \times 100 \times \frac{15}{16,5}$
11,9	825	Frames	$200 \times 90 \times 13$	$200 \times 90 \times 12,5$	$200 \times 90 \times 13$	$200 \times 90 \times 13,5$
		Reversed frames	$150 \times 90 \times 13$	$170 \times 90 \times 13$	$200 \times 90 \times 13$	$200 \times 90 \times 13,5$
		Depth of framing	280	290	305	330
		Bulb angle or channel frames	$300 \times 95 \times 13,5$	$300 \times 95 \times 16$	$280 \times 100 \times 100 \times \frac{14,5}{16,5}$	$300 \times 100 \times 100 \times \frac{13,5}{17}$
12,2	840	Frames	$200 \times 90 \times 12,5$	$200 \times 90 \times 12,5$	$200 \times 90 \times 13,5$	$225 \times 90 \times 13$
		Reversed frames	$170 \times 90 \times 13$	$180 \times 90 \times 13$	$200 \times 90 \times 13,5$	$200 \times 90 \times 13$
		Depth of framing	290	305	315	330
		Bulb angle or channel frames	$300 \times 95 \times 16$	$280 \times 100 \times 100 \times \frac{13,5}{16,5}$	$300 \times 100 \times 100 \times \frac{13}{17}$	$300 \times 100 \times 100 \times \frac{14,5}{17}$
12,5	850	Frames	$200 \times 90 \times 13$	$200 \times 90 \times 12,5$	$225 \times 90 \times 13$	$225 \times 90 \times 12,5$
		Reversed frames	$180 \times 90 \times 13,5$	$200 \times 90 \times 12,5$	$200 \times 90 \times 13$	$225 \times 90 \times 12,5$
		Depth of framing	290	315	315	345
		Bulb angle or channel frames	$300 \times 95 \times 17$	$280 \times 100 \times 100 \times \frac{15}{16,5}$	$300 \times 100 \times 100 \times \frac{14}{17}$	$320 \times 100 \times 100 \times \frac{13}{17,5}$
12,8	865	Frames	$200 \times 90 \times 13$	$200 \times 90 \times 13,5$	$225 \times 90 \times 13,5$	$225 \times 90 \times 13$
		Reversed frames	$200 \times 90 \times 13$	$200 \times 90 \times 13,5$	$200 \times 90 \times 13,5$	$225 \times 90 \times 13$
		Depth of framing	305	315	330	345
		Channel frames	$280 \times 100 \times 100 \times \frac{14,5}{16,5}$	$300 \times 100 \times 100 \times \frac{13}{17}$	$320 \times 100 \times 100 \times \frac{12,5}{17,5}$	$320 \times 100 \times 100 \times \frac{13,5}{17,5}$
13,1	875	Frames	$200 \times 90 \times 13,5$	$225 \times 90 \times 13$	$225 \times 90 \times 13$	$230 \times 100 \times 13$
		Reversed frames	$200 \times 90 \times 13,5$	$200 \times 90 \times 13,5$	$225 \times 90 \times 13$	$225 \times 90 \times 13,5$
		Depth of framing	315	330	345	355
		Channel frames	$300 \times 100 \times 100 \times \frac{13}{17}$	$300 \times 100 \times 100 \times \frac{14,5}{17}$	$320 \times 100 \times 100 \times \frac{13,5}{17,5}$	$320 \times 100 \times 100 \times \frac{15,5}{17,5}$
13,4	890	Frames	$200 \times 90 \times 14$	$225 \times 90 \times 13,5$	$225 \times 90 \times 13,5$	$230 \times 100 \times 13,5$
		Reversed frames	$200 \times 90 \times 14$	$200 \times 90 \times 14$	$225 \times 90 \times 13,5$	$225 \times 90 \times 14$
		Depth of framing	315	330	345	355
		Channel frames	$300 \times 100 \times 100 \times \frac{14}{17}$	$320 \times 100 \times 100 \times \frac{12,5}{17}$	$320 \times 100 \times 100 \times \frac{14,5}{17,5}$	$340 \times 100 \times 100 \times \frac{13,5}{18}$
13,7	900	Frames	$225 \times 90 \times 13,5$	$225 \times 90 \times 13$	$230 \times 100 \times 13,5$	$240 \times 100 \times 12,5$
		Reversed frames	$200 \times 90 \times 14$	$225 \times 90 \times 13$	$225 \times 90 \times 14$	$225 \times 100 \times 13$
		Depth of framing	330	345	355	370
		Channel frames	$320 \times 100 \times 100 \times \frac{12,5}{17}$	$320 \times 100 \times 100 \times \frac{13,5}{17}$	$340 \times 100 \times 100 \times \frac{13,5}{18}$	$340 \times 100 \times 100 \times \frac{15}{18}$
14,0	915	Frames	$225 \times 90 \times 13$	$220 \times 90 \times 14$	$230 \times 100 \times 14$	$240 \times 100 \times 13$
		Reversed frames	$225 \times 90 \times 13$	$220 \times 90 \times 14$	$225 \times 90 \times 14,5$	$225 \times 100 \times 13,5$
		Depth of framing	345	345	355	370
		Channel frames	$320 \times 100 \times 100 \times \frac{13,5}{17}$	$320 \times 100 \times 100 \times \frac{15,5}{17}$	$340 \times 100 \times 100 \times \frac{14,5}{18}$	$340 \times 100 \times 100 \times \frac{16,5}{18}$

SIDE FRAMING.

FULL SCANTLING VESSELS—FLUSH DECK.

TABLE 3 (CONCLUDED.)

D	FRAME SPACING.	TYPE OF FRAMING.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO LOWEST DECK AT SIDE.			
			Metres. 7,0	Metres. 7,3	Metres. 7,6	Metres. 7,9
Metres.	mm.		mm.	mm.	mm.	mm.
11,6	815	Frames	$225 \times 90 \times 13$	$225 \times 90 \times 13$	$230 \times 100 \times 13$	$230 \times 100 \times 14$
		Reversed frames	$200 \times 90 \times 13$	$225 \times 90 \times 13$	$225 \times 90 \times 13{,}5$	$225 \times 90 \times 14{,}5$
		Depth of framing	330	345	355	355
		Channel frames	$300 \times 100 \times 100 \times \frac{14{,}5}{17}$	$320 \times 100 \times 100 \times \frac{13{,}5}{17{,}5}$	$320 \times 100 \times 100 \times \frac{15{,}5}{17{,}5}$	$340 \times 100 \times 100 \times \frac{14{,}5}{18}$
11,9	825	Frames	$225 \times 90 \times 13{,}5$	$225 \times 90 \times 13{,}5$	$230 \times 100 \times 13{,}5$	$230 \times 100 \times 13{,}5$
		Reversed frames	$200 \times 90 \times 13{,}5$	$225 \times 90 \times 13{,}5$	$225 \times 90 \times 14$	$230 \times 100 \times 13{,}5$
		Depth of framing	330	345	355	370
		Channel frames	$320 \times 100 \times 100 \times \frac{12{,}5}{17}$	$320 \times 100 \times 100 \times \frac{14{,}5}{17}$	$340 \times 100 \times 100 \times \frac{13{,}5}{18}$	$340 \times 100 \times 100 \times \frac{16{,}5}{18}$
12,2	840	Frames	$225 \times 90 \times 13$	$230 \times 100 \times 13$	$240 \times 100 \times 12{,}5$	$240 \times 100 \times 13{,}5$
		Reversed frames	$225 \times 90 \times 13$	$225 \times 90 \times 13{,}5$	$225 \times 100 \times 13$	$225 \times 100 \times 14$
		Depth of framing	345	355	370	370
		Channel frames	$320 \times 100 \times 100 \times \frac{13{,}5}{17{,}5}$	$320 \times 100 \times 100 \times \frac{15{,}5}{17{,}5}$	$340 \times 100 \times 100 \times \frac{15}{18}$	$340 \times 100 \times 100 \times \frac{17}{18}$
12,5	850	Frames	$225 \times 90 \times 13{,}5$	$230 \times 100 \times 14$	$240 \times 100 \times 13$	$240 \times 100 \times 14{,}5$
		Reversed frames	$225 \times 90 \times 13{,}5$	$225 \times 90 \times 14{,}5$	$225 \times 100 \times 13{,}5$	$225 \times 100 \times 15$
		Depth of framing	345	355	370	370
		Channel frames	$320 \times 100 \times 100 \times \frac{14{,}5}{17{,}5}$	$340 \times 100 \times 100 \times \frac{14{,}5}{18}$	$340 \times 100 \times 100 \times \frac{16{,}5}{18}$	$340 \times 100 \times 100 \times \frac{18}{18}$
12,8	865	Frames	$230 \times 100 \times 13{,}5$	$230 \times 100 \times 14{,}5$	$240 \times 100 \times 14$	$240 \times 100 \times 15$
		Reversed frames	$225 \times 90 \times 14$	$225 \times 90 \times 15$	$225 \times 100 \times 14{,}5$	$225 \times 100 \times 15{,}5$
		Depth of framing	355	355	370	370
		Channel frames	$340 \times 100 \times 100 \times \frac{13{,}5}{18}$	$340 \times 100 \times 100 \times \frac{15}{18}$	$340 \times 100 \times 100 \times \frac{17{,}5}{18}$	—
13,1	875	Frames	$240 \times 100 \times 12{,}5$	$240 \times 100 \times 13{,}5$	$240 \times 100 \times 14{,}5$	$240 \times 100 \times 16$
		Reversed frames	$225 \times 100 \times 13$	$225 \times 100 \times 14$	$225 \times 100 \times 15$	$225 \times 100 \times 16{,}5$
		Depth of framing	370	370	370	370
		Channel frames	$340 \times 100 \times 100 \times \frac{15}{18}$	$340 \times 100 \times 100 \times \frac{17}{18}$	$340 \times 100 \times 100 \times \frac{18}{18}$	—
13,4	890	Frames	$240 \times 100 \times 13$	$240 \times 100 \times 14$	$240 \times 100 \times 15{,}5$	
		Reversed frames	$225 \times 100 \times 13{,}5$	$225 \times 100 \times 14{,}5$	$225 \times 100 \times 16$	
		Depth of framing	370	370	370	
		Channel frames	$340 \times 100 \times 100 \times \frac{16{,}5}{18}$	$340 \times 100 \times 100 \times \frac{17{,}5}{18}$	—	
13,7	900	Frames	$240 \times 100 \times 13{,}5$	$240 \times 100 \times 15$		
		Reversed frames	$225 \times 100 \times 14$	$225 \times 100 \times 15{,}5$		
		Depth of framing	370	370		
		Channel frames	$340 \times 100 \times 100 \times \frac{17}{18}$	—		
14,0	915	Frames	$240 \times 100 \times 14{,}5$			
		Reversed frames	$225 \times 100 \times 15$			
		Depth of framing	370			
		Channel frames	$340 \times 100 \times 100 \times \frac{18}{18}$			

SIDE FRAMING.

FULL SCANTLING VESSELS WITH 100 PER CENT. SUPERSTRUCTURES.

TABLE 3A

(SEE CONTINUATION.)

D	FRAME SPACING.	TYPE OF FRAMING.	FRAMING IN PEAKS	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO LOWEST DECK AT SIDE.				
				Metres. 2,45	Metres. 3,05	Metres. 3,65	Metres. 3,95	Metres. 4,25
Metres.	mm.		mm.	mm.	mm.	mm.	mm.	mm.
5,5	585	Frames	90×75× 7,5	90×75× 7,5	90×75× 8			
		Reversed frames	75×75× 7,5	90×75× 7,5	90×75× 8			
		Depth of framing	100	115	115			
		Bulb angle frames	140×75× 8,5	150×75× 8,5	150×75×10			
5,8	595	Frames	90×75× 8	90×75× 8,5	100×75× 8	100×75× 8		
		Reversed frames	75×75× 8	75×75× 9	90×75× 8,5	100×75× 8		
		Depth of framing	100	115	125	140		
		Bulb angle frames	140×75×10	150×75×11	170×75× 8,5	170×75×10		
6,1	595	Frames	90×75× 8,5	100×75× 8	100×75× 8,5	100×75× 8	120×75× 8	
		Reversed frames	75×75× 8,5	90×75× 8,5	90×75× 9	100×75× 8,5	100×75× 8,5	
		Depth of framing	100	125	125	140	150	
		Bulb angle frames	150×75× 8	170×75× 8,5	170×75× 9,5	170×75×11,5	180×75×10	
6,4	610	Frames	100×75× 8	100×75× 8,5	100×75× 9	100×75× 9	120×75× 8,5	120×75× 9
		Reversed frames	75×75× 8	90×75× 9	90×75× 9,5	100×75× 9	100×75× 9	100×75× 9,5
		Depth of framing	115	125	125	140	150	150
		Bulb angle frames	150×75×10	170×75× 9,5	170×75×11	180×75× 9	180×75×11,5	190×75× 9
6,7	610	Frames	100×75× 8,5	100×75× 9	100×75× 8,5	100×75× 9,5	120×75× 9	120×75× 9
		Reversed frames	75×75× 9	90×75× 9,5	100×75× 9	100×75× 9,5	100×75× 9,5	100×75× 9,5
		Depth of framing	115	125	140	140	150	150
		Bulb angle frames	150×75×11	170×75× 11	180×75× 9	180×75×10	190×75× 9	190×75× 9
7,0	620	Frames	120×75× 8,5	120×75× 8,5	120×75× 9	120×75× 8,5	120×75× 9	120×75× 9
		Reversed frames	75×75× 8,5	90×75× 9	90×75× 9,5	100×75× 9	100×75× 9,5	120×75× 9
		Depth of framing	125	140	140	150	150	165
		Bulb angle frames	170×75× 9,5	180×75× 9	180×75×10	180×75×11,5	190×75× 9	190×75×11,5
7,3	635	Frames	120×75× 9	130×75× 8	130×75× 8,5	130×75× 8,5	130×75× 9	130×75× 9,5
		Reversed frames	75×75× 9	90×75× 8,5	90×75× 9	100×75× 8,5	100×75× 9	120×75× 9,5
		Depth of framing	125	150	150	165	165	165
		Bulb angle frames	170×75×11	180×75×10	180×75×11,5	190×75×10	190×75×11,5	200×75×10
7,6	650	Frames	130×75× 8,5	130×75× 8,5	130×75× 9	130×75× 9	130×75× 9,5	130×75× 9,5
		Reversed frames	75×75× 8,5	90×75× 8,5	90×75× 9	100×75× 9	120×75× 9,5	130×75× 9,5
		Depth of framing	140	150	150	165	165	180
		Bulb angle frames	180×75× 9	180×75×11,5	190×75× 9	190×75×11,5	200×75×10	200×75×11,5
7,9	660	Frames	130×75× 9	130×90× 9	130×90× 9	130×90× 9,5	130×90× 9,5	130×90× 9,5
		Reversed frames	75×75× 9	75×90× 9	90×90× 9	100×90× 9,5	120×90× 9,5	120×90× 9,5
		Depth of framing	140	140	150	150	165	165
		Bulb angle frames	180×75× 10	190×85× 9,5	190×85×12	200×85×10	200×85×12	200×85×12
8,25	675	Frames	130×75× 9,5	130×90× 9	130×90× 9,5	130×90×10	130×90× 9,5	130×90× 9,5
		Reversed frames	90×75× 9,5	90×75× 9	100×90× 9,5	100×90×10	120×90× 9,5	130×90× 9,5
		Depth of framing	140	150	150	150	165	180
		Bulb angle frames	180×75×11	190×85×12	200×85×10	200×85×11	200×85×12	220×85×10,5

SIDE FRAMING.

FULL SCANTLING VESSELS WITH 100 PER CENT. SUPERSTRUCTURES.

TABLE 3A

(SEE CONTINUATION.)

D	FRAME SPACING.	TYPE OF FRAMING.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO LOWEST DECK AT SIDE.					
			Metres. 4,55	Metres. 4,9	Metres. 5,2	Metres. 5,5	Metres. 5,8	Metres. 6,1
Metres.	mm.		mm.	mm.	mm.	mm.	mm.	mm.
5,5	585	Frames Reversed frames Depth of framing Bulb angle frames						
5,8	595	Frames Reversed frames Depth of framing Bulb angle frames						
6,1	595	Frames Reversed frames Depth of framing Bulb angle frames						
6,4	610	Frames Reversed frames Depth of framing Bulb angle frames						
6,7	610	Frames Reversed frames Depth of framing Bulb angle frames	120 × 75 × 9 120 × 75 × 9 165 190 × 75 × 11,5					
7,0	620	Frames Reversed frames Depth of framing Bulb angle frames	130 × 75 × 9 120 × 75 × 9 180 200 × 75 × 11	130 × 75 × 9 130 × 75 × 9 190 220 × 75 × 9,5				
7,3	635	Frames Reversed frames Depth of framing Bulb angle frames	130 × 75 × 9,5 130 × 75 × 9,5 180 200 × 75 × 12	140 × 75 × 9,5 130 × 75 × 9,5 190 220 × 75 × 11	140 × 75 × 9,5 140 × 75 × 9,5 205 220 × 75 × 13			
7,6	650	Frames Reversed frames Depth of framing Bulb angle frames	130 × 75 × 10 130 × 75 × 10 180 200 × 75 × 13,5	140 × 75 × 10 130 × 75 × 10 190 220 × 75 × 12	140 × 75 × 10 140 × 75 × 10 205 230 × 90 × 10,5	150 × 75 × 10 140 × 75 × 10,5 215 230 × 90 × 13		
7,9	660	Frames Reversed frames Depth of framing Bulb angle frames	130 × 90 × 9,5 130 × 90 × 9,5 180 220 × 85 × 10,5	140 × 90 × 9,5 130 × 90 × 9,5 190 220 × 85 × 13	140 × 90 × 9,5 140 × 90 × 9,5 205 230 × 90 × 12	150 × 90 × 9,5 140 × 90 × 10 215 240 × 90 × 11		
8,25	675	Frames Reversed frames Depth of framing Bulb angle frames	130 × 90 × 10 130 × 90 × 10 180 220 × 85 × 12	140 × 90 × 10 130 × 90 × 10 190 230 × 90 × 11	140 × 90 × 10 140 × 90 × 10 205 240 × 90 × 10,5	150 × 90 × 10 140 × 90 × 10,5 215 240 × 90 × 12	150 × 90 × 11 150 × 90 × 11 230 250 × 90 × 13	

SIDE FRAMING.

FULL SCANTLING VESSELS WITH 100 PER CENT. SUPERSTRUCTURES.

TABLE 3A

(SEE CONTINUATION.)

D	FRAME SPACING.	TYPE OF FRAMING.	FRAMING IN PEAKS.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO LOWEST DECK AT SIDE.			
				Metres. 2,45	Metres. 3,05	Metres. 3,65	Metres. 3,95
Metres.	mm.		mm.	mm.	mm.	mm.	mm.
8,55	685	Frames	140 × 90 × 9	140 × 90 × 9,5	140 × 90 × 9,5	140 × 90 × 9,5	140 × 90 × 9,5
		Reversed frames	90 × 75 × 9	90 × 90 × 9,5	100 × 90 × 9,5	100 × 90 × 9,5	120 × 90 × 9,5
		Depth of framing	150	150	165	165	180
		Bulb angle frames	190 × 85 × 9,5	200 × 85 × 10	200 × 85 × 12	200 × 85 × 12	220 × 85 × 10,5
8,85	695	Frames	140 × 90 × 9,5	140 × 90 × 10	140 × 90 × 9,5	140 × 90 × 9,5	140 × 90 × 10
		Reversed frames	90 × 75 × 9,5	90 × 90 × 10	100 × 90 × 9,5	120 × 90 × 9,5	120 × 90 × 10
		Depth of framing	150	150	165	180	180
		Bulb angle frames	190 × 85 × 10,5	200 × 85 × 11	200 × 85 × 12	220 × 85 × 10,5	220 × 85 × 12
9,15	710	Frames	140 × 90 × 10	140 × 90 × 10	140 × 90 × 9,5	140 × 90 × 10	150 × 90 × 9,5
		Reversed frames	90 × 75 × 10	100 × 90 × 10	120 × 90 × 9,5	120 × 90 × 10	120 × 90 × 10
		Depth of framing	150	165	180	180	190
		Bulb angle frames	190 × 85 × 11,5	200 × 85 × 13	220 × 85 × 10,5	220 × 85 × 12	220 × 90 × 13
9,45	725	Frames	150 × 90 × 10	150 × 90 × 9,5	150 × 90 × 10	150 × 90 × 9,5	150 × 90 × 10
		Reversed frames	90 × 75 × 10,5	100 × 90 × 10	100 × 90 × 10,5	120 × 90 × 10	120 × 90 × 10,5
		Depth of framing	165	180	180	190	190
		Bulb angle frames	200 × 75 × 10,5	220 × 85 × 10,5	220 × 85 × 12	220 × 90 × 13	230 × 90 × 11
9,75	735	Frames	150 × 90 × 10,5	150 × 90 × 9,5	150 × 90 × 10	150 × 90 × 10,5	150 × 90 × 10
		Reversed frames	90 × 75 × 10,5	120 × 90 × 10	120 × 90 × 10,5	120 × 90 × 11	130 × 90 × 10,5
		Depth of framing	165	190	190	190	205
		Bulb angle frames	200 × 85 × 11,5	220 × 85 × 13	230 × 90 × 11	230 × 90 × 12	240 × 90 × 10,5
10,0	750	Frames	170 × 90 × 10,5	170 × 90 × 10	170 × 90 × 10,5	170 × 90 × 10	170 × 90 × 10,5
		Reversed frames	90 × 75 × 10,5	100 × 90 × 10	100 × 90 × 10,5	120 × 90 × 10	120 × 90 × 10,5
		Depth of framing	180	190	190	205	205
		Bulb angle frames	220 × 85 × 10,5	230 × 90 × 11	230 × 90 × 12	240 × 90 × 10,5	240 × 90 × 11,5
10,35	760	Frames	180 × 90 × 10,5	180 × 90 × 11	180 × 90 × 10	180 × 90 × 10	180 × 90 × 9,5
		Reversed frames	90 × 75 × 10,5	90 × 90 × 11	100 × 90 × 10	120 × 90 × 10	130 × 90 × 9,5
		Depth of framing	190	190	205	215	230
		Bulb angle frames	220 × 85 × 13	230 × 90 × 13	240 × 90 × 10,5	240 × 90 × 12	240 × 90 × 13
10,65	775	Frames	200 × 90 × 10	200 × 90 × 10	200 × 90 × 9,5	200 × 90 × 9	200 × 90 × 9,5
		Reversed frames	90 × 75 × 10,5	90 × 90 × 10,5	100 × 90 × 10	120 × 90 × 9,5	120 × 90 × 10
		Depth of framing	205	205	215	230	230
		Bulb angle frames	230 × 90 × 11,5	240 × 90 × 11,5	240 × 90 × 12	240 × 90 × 13	250 × 90 × 12
10,95	785	Frames	200 × 90 × 10	200 × 90 × 10	200 × 90 × 9,5	200 × 90 × 10	200 × 90 × 9,5
		Reversed frames	90 × 90 × 10,5	90 × 90 × 10,5	100 × 90 × 10	100 × 90 × 10,5	120 × 90 × 10
		Depth of framing	205	215	230	230	240
		Bulb angle frames	240 × 90 × 11,5	240 × 90 × 12	240 × 90 × 13	250 × 90 × 12	250 × 90 × 12,5
11,3	800	Frames	200 × 90 × 10,5	200 × 90 × 10,5	200 × 90 × 10	200 × 90 × 10	200 × 90 × 10,5
		Reversed frames	90 × 90 × 11	90 × 90 × 11	100 × 90 × 10,5	120 × 90 × 10,5	120 × 90 × 11
		Depth of framing	215	215	230	240	240
		Bulb angle frames	240 × 90 × 13	240 × 90 × 13	250 × 90 × 12	250 × 90 × 14	270 × 90 × 11,5

SIDE FRAMING.

FULL SCANTLING VESSELS WITH 100 PER CENT. SUPERSTRUCTURES.

TABLE 3A

(SEE CONTINUATION.)

D	FRAME SPACING.	TYPE OF FRAMING.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO LOWEST DECK AT SIDE.				
			Metres. 4,25	Metres. 4,55	Metres. 4,9	Metres. 5,2	Metres. 5,5
Metres.	mm.		mm.	mm.	mm.	mm.	mm.
8,55	685	Frames	140 × 90 × 10	140 × 90 × 10	140 × 90 × 10	150 × 90 × 10	150 × 90 × 10,5
		Reversed frames	120 × 90 × 10	130 × 90 × 10	140 × 90 × 10	140 × 90 × 10,5	150 × 90 × 10,5
		Depth of framing	180	190	205	215	230
		Bulb angle frames	220 × 85 × 12	230 × 90 × 11	240 × 90 × 10,5	240 × 90 × 12	250 × 90 × 12
8,85	695	Frames	150 × 90 × 9,5	150 × 90 × 9,5	150 × 90 × 9,5	150 × 90 × 10	170 × 90 × 9,5
		Reversed frames	120 × 90 × 9,5	130 × 90 × 9,5	140 × 90 × 9,5	150 × 90 × 10	150 × 90 × 10
		Depth of framing	190	205	215	230	240
		Bulb angle frames	220 × 85 × 13	230 × 90 × 12	240 × 90 × 11	240 × 90 × 13	250 × 90 × 12,5
9,15	710	Frames	150 × 90 × 9,5	150 × 90 × 10	150 × 90 × 10	150 × 90 × 10,5	170 × 90 × 10
		Reversed frames	130 × 90 × 10	130 × 90 × 10,5	140 × 90 × 10,5	150 × 90 × 10,5	150 × 90 × 10,5
		Depth of framing	205	205	215	230	240
		Bulb angle frames	230 × 90 × 12	240 × 90 × 10,5	240 × 90 × 12	250 × 90 × 12	250 × 90 × 14
9,45	725	Frames	150 × 90 × 10	150 × 90 × 10	150 × 90 × 10	150 × 90 × 11	170 × 90 × 10,5
		Reversed frames	130 × 90 × 10,5	140 × 90 × 10,5	150 × 90 × 10	150 × 90 × 11	150 × 90 × 11
		Depth of framing	205	215	230	230	240
		Bulb angle frames	240 × 90 × 10,5	240 × 90 × 12	240 × 90 × 13	250 × 90 × 13	270 × 90 × 11,5
9,75	735	Frames	150 × 90 × 10,5	170 × 90 × 9,5	170 × 90 × 9,5	170 × 90 × 9,5	170 × 90 × 10,5
		Reversed frames	130 × 90 × 11	140 × 90 × 9,5	150 × 90 × 10	170 × 90 × 9,5	170 × 90 × 10,5
		Depth of framing	205	230	240	250	255
		Bulb angle frames	240 × 90 × 11,5	240 × 90 × 13	250 × 90 × 12,5	250 × 90 × 14,5	270 × 90 × 13
10,0	750	Frames	170 × 90 × 9,5	170 × 90 × 10	170 × 90 × 10	170 × 90 × 10	170 × 90 × 11
		Reversed frames	140 × 90 × 9,5	140 × 90 × 10	150 × 90 × 10,5	170 × 90 × 10	170 × 90 × 11
		Depth of framing	230	230	240	255	255
		Bulb angle frames	240 × 90 × 13	250 × 90 × 12	250 × 90 × 14	270 × 90 × 12	270 × 90 × 14,5
10,35	760	Frames	180 × 90 × 10	180 × 90 × 9,5	180 × 90 × 9,5	180 × 90 × 10,5	180 × 90 × 11
		Reversed frames	130 × 90 × 10	140 × 90 × 9,5	150 × 90 × 10	150 × 90 × 11	170 × 90 × 11
		Depth of framing	230	240	255	255	265
		Bulb angle frames	250 × 90 × 12	250 × 90 × 12,5	250 × 90 × 14,5	270 × 90 × 13	280 × 90 × 13,5
10,65	775	Frames	200 × 90 × 9	200 × 90 × 9,5	200 × 90 × 10,5	200 × 90 × 10,5	200 × 90 × 11,5
		Reversed frames	130 × 90 × 9,5	130 × 90 × 10	130 × 90 × 11	140 × 90 × 11	140 × 90 × 12
		Depth of framing	240	255	255	265	265
		Bulb angle frames	250 × 90 × 12,5	250 × 90 × 14,5	270 × 90 × 13	280 × 90 × 12,5	290 × 90 × 12,5
10,95	785	Frames	200 × 90 × 10	200 × 90 × 10	200 × 90 × 11	200 × 90 × 11	200 × 90 × 11,5
		Reversed frames	120 × 90 × 10,5	130 × 90 × 10,5	130 × 90 × 11,5	140 × 90 × 11,5	150 × 90 × 12
		Depth of framing	240	255	255	265	280
		Bulb angle frames	250 × 90 × 14	270 × 90 × 12	270 × 90 × 14,5	280 × 90 × 13,5	290 × 90 × 14
11,3	800	Frames	200 × 90 × 10	200 × 90 × 10	200 × 90 × 10,5	200 × 90 × 11,5	200 × 90 × 11
		Reversed frames	130 × 90 × 10,5	140 × 90 × 10,5	140 × 90 × 11	150 × 90 × 11,5	170 × 90 × 11,5
		Depth of framing	255	265	265	280	290
		Bulb angle frames	270 × 90 × 12	270 × 90 × 14	280 × 90 × 14,5	290 × 90 × 13	300 × 95 × 12,5

SIDE FRAMING.

FULL SCANTLING VESSELS WITH 100 PER CENT. SUPERSTRUCTURES.

TABLE 3A
(SEE CONTINUATION.)

D	FRAME SPACING.	TYPE OF FRAMING.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO LOWEST DECK AT SIDE.			
			Metres. 5,8	Metres. 6,1	Metres. 6,4	Metres. 6,7
Metres.	mm.		mm.	mm.	mm.	mm.
8,55	685	Frames	$170 \times 90 \times 10$	$170 \times 90 \times 10$		
		Reversed frames	$150 \times 90 \times 10{,}5$	$170 \times 90 \times 10$		
		Depth of framing	240	255		
		Bulb angle frames	$250 \times 90 \times 14$	$270 \times 90 \times 12$		
8,85	695	Frames	$170 \times 90 \times 10{,}5$	$170 \times 90 \times 11$	$180 \times 90 \times 11$	
		Reversed frames	$170 \times 90 \times 11$	$170 \times 90 \times 11$	$170 \times 90 \times 11$	
		Depth of framing	240	255	265	
		Bulb angle frames	$270 \times 90 \times 11{,}5$	$270 \times 90 \times 14{,}5$	$280 \times 90 \times 13{,}5$	
9,15	710	Frames	$170 \times 90 \times 10{,}5$	$180 \times 90 \times 10{,}5$	$180 \times 90 \times 11{,}5$	$180 \times 90 \times 11{,}5$
		Reversed frames	$170 \times 90 \times 10{,}5$	$170 \times 90 \times 10{,}5$	$170 \times 90 \times 11{,}5$	$180 \times 90 \times 11{,}5$
		Depth of framing	255	265	265	280
		Bulb angle frames	$270 \times 90 \times 13$	$280 \times 90 \times 12{,}5$	$290 \times 90 \times 12{,}5$	$290 \times 90 \times 14$
9,45	725	Frames	$170 \times 90 \times 11$	$180 \times 90 \times 11$	$180 \times 90 \times 11{,}5$	$200 \times 90 \times 11$
		Reversed frames	$170 \times 90 \times 11$	$170 \times 90 \times 11$	$180 \times 90 \times 11{,}5$	$180 \times 90 \times 11{,}5$
		Depth of framing	255	265	280	290
		Bulb angle frames	$270 \times 90 \times 14{,}5$	$280 \times 90 \times 13{,}5$	$290 \times 90 \times 14$	$300 \times 95 \times 13{,}5$
9,75	735	Frames	$180 \times 90 \times 11$	$180 \times 90 \times 11$	$200 \times 90 \times 10{,}5$	$200 \times 90 \times 11$
		Reversed frames	$170 \times 90 \times 11$	$180 \times 90 \times 11$	$180 \times 90 \times 11$	$200 \times 90 \times 11$
		Depth of framing	265	280	290	305
		Bulb angle frames	$280 \times 90 \times 13{,}5$	$290 \times 90 \times 13$	$300 \times 95 \times 12{,}5$	$300 \times 95 \times 15{,}5$
10,0	750	Frames	$180 \times 90 \times 11{,}5$	$180 \times 90 \times 11{,}5$	$200 \times 90 \times 11$	$200 \times 90 \times 11{,}5$
		Reversed frames	$170 \times 90 \times 11{,}5$	$180 \times 90 \times 11{,}5$	$180 \times 90 \times 11{,}5$	$200 \times 90 \times 11{,}5$
		Depth of framing	255	280	290	305
		Bulb angle frames	$290 \times 90 \times 12{,}5$	$290 \times 90 \times 14$	$300 \times 95 \times 13{,}5$	$300 \times 95 \times 17$
10,35	760	Frames	$200 \times 90 \times 10{,}5$	$200 \times 90 \times 11$	$200 \times 90 \times 11$	$200 \times 90 \times 12{,}5$
		Reversed frames	$170 \times 90 \times 11$	$180 \times 90 \times 11{,}5$	$200 \times 90 \times 11$	$200 \times 90 \times 12$
		Depth of framing	280	290	305	315
		Bulb angle or channel frames	$290 \times 90 \times 13$	$300 \times 90 \times 13{,}5$	$300 \times 90 \times 15{,}5$	$280 \times 100 \times 100 \times \frac{14}{16{,}5}$
10,65	775	Frames	$200 \times 90 \times 11{,}5$	$200 \times 90 \times 12$	$200 \times 90 \times 12$	$200 \times 90 \times 12{,}5$
		Reversed frames	$150 \times 90 \times 12$	$170 \times 90 \times 12{,}5$	$180 \times 90 \times 12{,}5$	$200 \times 90 \times 12{,}5$
		Depth of framing	280	290	305	315
		Bulb angle or channel frames	$290 \times 90 \times 14$	$300 \times 95 \times 14{,}5$	$300 \times 95 \times 17$	$280 \times 100 \times 100 \times \frac{15}{16{,}5}$
10,95	785	Frames	$200 \times 90 \times 11{,}5$	$200 \times 90 \times 12{,}5$	$200 \times 90 \times 13$	$200 \times 90 \times 13{,}5$
		Reversed frames	$170 \times 90 \times 12$	$170 \times 90 \times 13$	$200 \times 90 \times 13$	$200 \times 90 \times 13{,}5$
		Depth of framing	290	290	305	315
		Bulb angle or channel frames	$300 \times 95 \times 13{,}5$	$300 \times 95 \times 16$	$280 \times 100 \times 100 \times \frac{14{,}5}{16{,}5}$	$300 \times 100 \times 100 \times \frac{13}{17}$
11,3	800	Frames	$200 \times 90 \times 11{,}5$	$200 \times 90 \times 12{,}5$	$200 \times 90 \times 13{,}5$	$225 \times 90 \times 13$
		Reversed frames	$180 \times 90 \times 11{,}5$	$180 \times 90 \times 12{,}5$	$200 \times 90 \times 13{,}5$	$200 \times 90 \times 13$
		Depth of framing	305	305	305	330
		Bulb angle or channel frames	$300 \times 95 \times 15$	$280 \times 100 \times 100 \times \frac{13{,}5}{16{,}5}$	$280 \times 100 \times 100 \times \frac{15}{16{,}5}$	$300 \times 100 \times 100 \times \frac{14{,}5}{17}$

SIDE FRAMING.

FULL SCANTLING VESSELS WITH 100 PER CENT. SUPERSTRUCTURES.

TABLE 3A

(SEE CONTINUATION.)

D	FRAME SPACING.	TYPE OF FRAMING.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO LOWEST DECK AT SIDE.			
			Metres. 7,0	Metres 7,3	Metres. 7,6	Metres. 7,9
Metres.	mm.		mm.	mm.	mm.	mm.
8,55	685	Frames				
		Reversed frames				
		Depth of framing				
		Bulb angle frames				
8,85	695	Frames				
		Reversed frames				
		Depth of framing				
		Bulb angle frames				
9,15	710	Frames				
		Reversed frames				
		Depth of framing				
		Bulb angle frames				
9,45	725	Frames	200 × 90 × 11,5			
		Reversed frames	200 × 90 × 11,5			
		Depth of framing	305			
		Bulb angle frames	300 × 95 × 17			
9,75	735	Frames	200 × 90 × 11,5	200 × 90 × 12,5		
		Reversed frames	200 × 90 × 11,5	200 × 90 × 12,5		
		Depth of framing	315	330		
		Channel frames	280 × 100 × 100 × 13 / 16,5	300 × 100 × 100 × 12,5 / 17		
10,0	750	Frames	200 × 90 × 12	200 × 90 × 13		
		Reversed frames	200 × 90 × 12	200 × 90 × 13		
		Depth of framing	330	330		
		Channel frames	280 × 100 × 100 × 14,5 / 16,5	300 × 100 × 100 × 13,5 / 17		
10,35	760	Frames	200 × 90 × 12,5	225 × 90 × 13	230 × 100 × 13,5	
		Reversed frames	200 × 90 × 12,5	200 × 90 × 13	200 × 90 × 14	
		Depth of framing	330	330	345	
		Channel frames	300 × 100 × 100 × 12,5 / 17	300 × 100 × 100 × 14,5 / 17	320 × 100 × 100 × 13,5 / 17,5	
10,65	775	Frames	225 × 90 × 13	230 × 100 × 13	230 × 100 × 14	230 × 100 × 13,5
		Reversed frames	200 × 90 × 13	200 × 90 × 13,5	200 × 90 × 14,5	225 × 90 × 14
		Depth of framing	330	345	345	355
		Channel frames ..	300 × 100 × 100 × 14,5 / 17	320 × 100 × 100 × 13 / 17,5	320 × 100 × 100 × 14,5 / 17,5	340 × 100 × 100 × 13,5 / 18
10,95	785	Frames	225 × 90 × 13,5	230 × 100 × 13,5	230 × 100 × 13,5	230 × 100 × 14,5
		Reversed frames	200 × 90 × 13,5	200 × 90 × 14	225 × 90 × 14	225 × 90 × 15
		Depth of framing	330	345	355	355
		Channel frames	320 × 100 × 100 × 12,5 / 17,5	320 × 100 × 100 × 13,5 / 17,5	340 × 100 × 100 × 13,5 / 18	340 × 100 × 100 × 15 / 18
11,3	800	Frames	225 × 90 × 13	230 × 100 × 14	230 × 100 × 14	240 × 100 × 13,5
		Reversed frames	225 × 90 × 13	200 × 90 × 14,5	225 × 90 × 14,5	225 × 100 × 13,5
		Depth of framing	345	345	355	370
		Channel frames	320 × 100 × 100 × 13 / 17,5	320 × 100 × 100 × 14,5 / 17,5	340 × 100 × 100 × 14,5 / 18	340 × 100 × 100 × 16,5 / 18

SIDE FRAMING.

FULL SCANTLING VESSELS WITH 100 PER CENT. SUPERSTRUCTURES.

TABLE 3A

(SEE CONTINUATION.)

D	FRAME SPACING.	TYPE OF FRAMING.	FRAMING IN PEAKS.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO LOWEST DECK AT SIDE.			
				Metres. 2,45	Metres. 3,05	Metres. 3,65	Metres. 3,95
Metres.	mm.		mm.	mm.	mm.	mm.	mm.
11,6	815	Frames	200 × 90 × 10,5	200 × 90 × 10,5	200 × 90 × 10	200 × 90 × 10,5	200 × 90 × 11
		Reversed frames	100 × 90 × 11	100 × 90 × 11	120 × 90 × 10,5	120 × 90 × 11	120 × 90 × 11,5
		Depth of framing	230	230	230	230	240
		Bulb angle frames	250 × 90 × 13	250 × 90 × 13	250 × 90 × 14	270 × 90 × 11,5	270 × 90 × 12,5
11,9	825	Frames	200 × 90 × 11	200 × 90 × 10,5	200 × 90 × 10	200 × 90 × 10,5	200 × 90 × 11
		Reversed frames	100 × 90 × 11,5	120 × 90 × 11	130 × 90 × 10,5	130 × 90 × 11	130 × 90 × 11,5
		Depth of framing	230	240	255	255	255
		Bulb angle frames	250 × 90 × 14	270 × 90 × 11,5	270 × 90 × 12	270 × 90 × 13	270 × 90 × 14,5
12,2	840	Frames	200 × 90 × 11	200 × 90 × 11	200 × 90 × 10,5	200 × 90 × 11	200 × 90 × 11,5
		Reversed frames	100 × 90 × 12	120 × 90 × 11,5	130 × 90 × 11	130 × 90 × 11,5	130 × 90 × 12
		Depth of framing	230	240	255	255	255
		Bulb angle frames	270 × 90 × 12	270 × 90 × 12	270 × 90 × 13	270 × 90 × 14,5	280 × 90 × 12,5
12,5	850	Frames	200 × 90 × 11	200 × 90 × 11	200 × 90 × 10,5	200 × 90 × 11	200 × 90 × 11,5
		Reversed frames	120 × 90 × 11,5	130 × 90 × 11,5	140 × 90 × 11	140 × 90 × 11,5	140 × 90 × 12
		Depth of framing	240	255	265	265	265
		Bulb angle frames	270 × 90 × 12,5	270 × 90 × 14,5	280 × 90 × 12,5	280 × 90 × 13,5	290 × 90 × 12,5
12,8	865	Frames	200 × 90 × 11,5	200 × 90 × 11	200 × 90 × 11,5	200 × 90 × 11	200 × 90 × 11,5
		Reversed frames	120 × 90 × 12	140 × 90 × 11,5	140 × 90 × 12	150 × 90 × 11,5	150 × 90 × 12
		Depth of framing	240	265	265	280	280
		Bulb angle frames	270 × 90 × 13,5	280 × 90 × 13,5	290 × 90 × 12,5	290 × 90 × 13	290 × 90 × 14
13,1	875	Frames	200 × 90 × 11,5	200 × 90 × 11	200 × 90 × 11,5	200 × 90 × 11	200 × 90 × 11,5
		Reversed frames	130 × 90 × 12	150 × 90 × 11,5	150 × 90 × 12	170 × 90 × 11,5	170 × 90 × 12
		Depth of framing	255	280	280	290	290
		Bulb angle frames	280 × 90 × 12,5	290 × 90 × 13	290 × 90 × 14	300 × 95 × 12,5	300 × 95 × 13,5
13,4	890	Frames	200 × 90 × 11,5	200 × 90 × 11,5	200 × 90 × 12	200 × 90 × 11,5	200 × 90 × 12
		Reversed frames	140 × 90 × 12	150 × 90 × 12	150 × 90 × 12,5	170 × 90 × 12	170 × 90 × 12,5
		Depth of framing	265	280	280	290	290
		Bulb angle frames	290 × 90 × 12,5	290 × 90 × 14	300 × 95 × 12,5	300 × 95 × 13,5	300 × 95 × 14,5
13,7	900	Frames	200 × 90 × 12	200 × 90 × 11,5	200 × 90 × 12	200 × 90 × 11,5	200 × 90 × 12
		Reversed frames	140 × 90 × 12,5	170 × 90 × 12	170 × 90 × 12,5	180 × 90 × 12	180 × 90 × 12,5
		Depth of framing	265	290	290	305	305
		Bulb angle frames	290 × 90 × 13	300 × 95 × 13,5	300 × 95 × 14,5	300 × 95 × 15,5	300 × 95 × 17
14,0	915	Frames	200 × 90 × 12	200 × 90 × 12	200 × 90 × 12	200 × 90 × 12,5	200 × 90 × 12
		Reversed frames	150 × 90 × 12,5	170 × 90 × 12,5	180 × 90 × 12,5	180 × 90 × 13	200 × 90 × 12
		Depth of framing	280	290	305	305	315
		Bulb angle or channel frames	290 × 90 × 15,5	300 × 95 × 14,5	300 × 95 × 17	280 × 100 × 100 × 13,5 / 16,5	280 × 100 × 100 × 14 / 16,5

SIDE FRAMING.

FULL SCANTLING VESSELS WITH 100 PER CENT. SUPERSTRUCTURES.

TABLE 3A

(SEE CONTINUATION.)

D	FRAME SPACING.	TYPE OF FRAMING.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO LOWEST DECK AT SIDE.				
			Metres. 4,25	Metres. 4,55	Metres. 4,9	Metres. 5,2	Metres. 5,5
Metres.	mm.		mm.	mm.	mm.	mm.	mm.
11,6	815	Frames	200 × 90 × 11	200 × 90 × 10,5	200 × 90 × 11	200 × 90 × 12	200 × 90 × 11,5
		Reversed frames	130 × 90 × 11,5	140 × 90 × 11	150 × 90 × 11	150 × 90 × 12	170 × 90 × 12
		Depth of framing	255	265	280	280	290
		Bulb angle frames	270 × 90 × 14,5	280 × 90 × 12,5	290 × 90 × 12,5	290 × 90 × 14	300 × 95 × 13,5
11,9	825	Frames	200 × 90 × 10,5	200 × 90 × 11	200 × 90 × 11,5	200 × 90 × 11,5	200 × 90 × 11,5
		Reversed frames	140 × 90 × 11	150 × 90 × 11	150 × 90 × 11,5	170 × 90 × 12	180 × 90 × 12
		Depth of framing	265	280	280	290	305
		Bulb angle frames	280 × 90 × 12,5	290 × 90 × 12,5	290 × 90 × 13	300 × 95 × 13,5	300 × 90 × 15,5
12,2	840	Frames	200 × 90 × 11	200 × 90 × 11,5	200 × 90 × 11	200 × 90 × 12	200 × 90 × 12
		Reversed frames	140 × 90 × 11,5	150 × 90 × 11,5	170 × 90 × 11,5	170 × 90 × 12,5	180 × 90 × 12,5
		Depth of framing	265	280	290	290	305
		Bulb angle frames	280 × 90 × 13,5	290 × 90 × 13	300 × 95 × 12,5	300 × 95 × 14,5	300 × 95 × 17
12,5	850	Frames	200 × 90 × 11	200 × 90 × 11	200 × 90 × 11	200 × 90 × 12	200 × 90 × 12,5
		Reversed frames	150 × 90 × 11,5	170 × 90 × 11,5	180 × 90 × 11,5	180 × 90 × 12,5	200 × 90 × 12,5
		Depth of framing	280	290	305	305	315
		Bulb angle or channel frames	290 × 90 × 13	300 × 95 × 12,5	300 × 95 × 14,5	300 × 95 × 17	280 × 100 × 100 × 14 / 16,5
12,8	865	Frames	200 × 90 × 11	200 × 90 × 11	200 × 90 × 11,5	200 × 90 × 12,5	200 × 90 × 12,5
		Reversed frames	170 × 90 × 11,5	180 × 90 × 11,5	180 × 90 × 12	180 × 90 × 13	200 × 90 × 12,5
		Depth of framing	290	305	305	305	315
		Bulb angle or channel frames	300 × 95 × 12,5	300 × 95 × 14,5	300 × 95 × 15,5	280 × 100 × 100 × 13,5 / 16,5	280 × 100 × 100 × 15 / 16,5
13,1	875	Frames	200 × 90 × 11	200 × 90 × 11,5	200 × 90 × 11,5	200 × 90 × 12,5	200 × 90 × 13
		Reversed frames	180 × 90 × 11,5	180 × 90 × 12	200 × 90 × 11,5	200 × 90 × 12,5	200 × 90 × 13
		Depth of framing	305	305	315	315	330
		Bulb angle or channel frames	300 × 90 × 14,5	300 × 95 × 15,5	280 × 100 × 100 × 13 / 16,5	280 × 100 × 100 × 15 / 16,5	300 × 100 × 100 × 13,5 / 17
13,4	890	Frames	200 × 90 × 11,5	200 × 90 × 12	200 × 90 × 12	200 × 90 × 13	225 × 90 × 12,5
		Reversed frames	180 × 90 × 12	180 × 90 × 12,5	200 × 90 × 12	200 × 90 × 13	200 × 90 × 12,5
		Depth of framing	305	305	315	330	345
		Bulb angle or channel frames	300 × 95 × 15,5	300 × 95 × 17	280 × 100 × 100 × 14 / 16,5	300 × 100 × 100 × 12,5 / 17	320 × 100 × 100 × 12,5 / 17,5
13,7	900	Frames	200 × 90 × 11,5	200 × 90 × 12	200 × 90 × 12,5	225 × 90 × 12	230 × 100 × 13
		Reversed frames	200 × 90 × 11,5	200 × 90 × 12	200 × 90 × 12,5	200 × 90 × 12	200 × 90 × 13
		Depth of framing	315	315	330	345	345
		Channel frames	280 × 100 × 100 × 13 / 16,5	280 × 100 × 100 × 14 / 16,5	300 × 100 × 100 × 12,5 / 17	300 × 100 × 100 × 14,5 / 17	320 × 100 × 100 × 13 / 17,5
14,0	915	Frames	200 × 90 × 12,5	200 × 90 × 12,5	225 × 90 × 12	230 × 100 × 12	230 × 100 × 12,5
		Reversed frames	200 × 90 × 12,5	200 × 90 × 12,5	200 × 90 × 12	200 × 90 × 12	225 × 90 × 13
		Depth of framing	315	330	345	355	355
		Channel frames	280 × 100 × 100 × 15 / 16,5	300 × 100 × 100 × 12,5 / 17	300 × 100 × 100 × 14,5 / 17	320 × 100 × 100 × 12,5 / 17,5	320 × 100 × 100 × 14,5 / 17,5

SIDE FRAMING.

FULL SCANTLING VESSELS WITH 100 PER CENT. SUPERSTRUCTURES.

TABLE 3A

(SEE CONTINUATION.)

D	FRAME SPACING.	TYPE OF FRAMING.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO LOWEST DECK AT SIDE.			
			Metres. 5,8	Metres. 6,1	Metres. 6,4	Metres. 6,7
Metres.	mm.		mm.	mm.	mm.	mm.
11,6	815	Frames Reversed frames Depth of framing Bulb angle or channel frames	200 × 90 × 12 180 × 90 × 12,5 305 300 × 95 × 17	200 × 90 × 13 200 × 90 × 13 305 280 × 100 × 100 × 14,5 / 16,5	200 × 90 × 14 200 × 90 × 14 315 300 × 100 × 100 × 14 / 17	225 × 90 × 13,5 200 × 90 × 13,5 330 320 × 100 × 100 × 12,5 / 17,5
11,9	825	Frames Reversed frames Depth of framing Channel frames	200 × 90 × 12,5 180 × 90 × 13 305 280 × 100 × 100 × 13,5 / 16,5	200 × 90 × 13,5 200 × 90 × 13,5 315 300 × 100 × 100 × 13 / 17	225 × 90 × 13 200 × 90 × 13 330 300 × 100 × 100 × 14,5 / 17	225 × 90 × 13 225 × 90 × 13 345 320 × 100 × 100 × 13,5 / 17,5
12,2	840	Frames Reversed frames Depth of framing Channel frames	200 × 90 × 13 200 × 90 × 13 315 280 × 100 × 100 × 15 / 16,5	200 × 90 × 14 200 × 90 × 14 315 300 × 100 × 100 × 14 / 17	225 × 90 × 13,5 200 × 90 × 14 330 320 × 100 × 100 × 12,5 / 17	225 × 90 × 13,5 225 × 90 × 13,5 345 320 × 100 × 100 × 14,5 / 17
12,5	850	Frames Reversed frames Depth of framing Channel frames	200 × 90 × 13,5 200 × 90 × 13,5 315 300 × 100 × 100 × 13 / 17	225 × 90 × 13,5 200 × 90 × 13,5 330 320 × 100 × 100 × 12,5 / 17,5	230 × 100 × 13,5 200 × 90 × 14 345 320 × 100 × 100 × 13,5 / 17	230 × 100 × 13 225 × 90 × 13,5 355 320 × 100 × 100 × 15,5 / 17,5
12,8	865	Frames Reversed frames Depth of framing Channel frames	225 × 90 × 13 200 × 90 × 13 330 300 × 100 × 100 × 14,5 / 17	230 × 100 × 13 200 × 90 × 13,5 345 320 × 100 × 100 × 13 / 17,5	230 × 100 × 13 225 × 90 × 13,5 355 320 × 100 × 100 × 15,5 / 17,5	230 × 100 × 14 230 × 100 × 14,5 355 340 × 100 × 100 × 14,5 / 18
13,1	875	Frames Reversed frames Depth of framing Channel frames	225 × 90 × 12,5 225 × 90 × 12,5 345 320 × 100 × 100 × 13 / 17,5	230 × 100 × 12,5 225 × 90 × 13 355 320 × 100 × 100 × 14,5 / 17	230 × 100 × 13,5 225 × 90 × 14 355 340 × 100 × 100 × 13,5 / 18	240 × 100 × 13 225 × 100 × 13 370 340 × 100 × 100 × 14,5 / 17
13,4	890	Frames Reversed frames Depth of framing Channel frames	230 × 100 × 12,5 200 × 90 × 13 355 320 × 100 × 100 × 13,5 / 17,5	230 × 100 × 13 225 × 90 × 13,5 355 320 × 100 × 100 × 15,5 / 17,5	230 × 100 × 14 225 × 90 × 14,5 355 340 × 100 × 100 × 14,5 / 18	240 × 100 × 14 225 × 100 × 14 370 340 × 100 × 100 × 17 / 18
13,7	900	Frames Reversed frames Depth of framing Channel frames	230 × 100 × 12,5 225 × 90 × 13 355 320 × 100 × 100 × 14,5 / 17,5	230 × 100 × 13,5 225 × 90 × 14 355 340 × 100 × 100 × 13,5 / 18	240 × 100 × 13 225 × 100 × 13 370 340 × 100 × 100 × 14,5 / 17	240 × 100 × 14,5 225 × 100 × 14,5 370 340 × 100 × 100 × 17,5 / 18
14,0	915	Frames Reversed frames Depth of framing Channel frames	230 × 100 × 13,5 225 × 100 × 14 355 340 × 100 × 100 × 13,5 / 18	230 × 100 × 13 230 × 100 × 13 370 340 × 100 × 100 × 15 / 18	240 × 100 × 14 225 × 100 × 14 370 340 × 100 × 100 × 17 / 18	240 × 100 × 15,5 225 × 100 × 15,5 370

SIDE FRAMING.

FULL SCANTLING VESSELS WITH 100 PER CENT. SUPERSTRUCTURES.

TABLE 3A (CONCLUDED.)

D	FRAME SPACING.	TYPE OF FRAMING.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO LOWEST DECK AT SIDE.			
			Metres. 7,0	Metres. 7,3	Metres. 7,6	Metres. 7,9
Metres.	mm.		mm.	mm.	mm.	mm.
11,6	815	Frames	225 × 90 × 13,5	230 × 100 × 13,5	240 × 100 × 13	240 × 100 × 14,5
		Reversed frames	225 × 90 × 13,5	225 × 90 × 14	225 × 100 × 13	225 × 100 × 14,5
		Depth of framing	345	355	370	370
		Channel frames	320 × 100 × 100 × 14,5 / 17,5	340 × 100 × 100 × 13,5 / 18	340 × 100 × 100 × 15 / 18	340 × 100 × 100 × 17,5 / 18,0
11,9	825	Frames	230 × 100 × 13	230 × 100 × 14	240 × 100 × 14	240 × 100 × 15
		Reversed frames	225 × 90 × 13,5	225 × 90 × 14,5	225 × 100 × 14	225 × 100 × 15
		Depth of framing	355	355	370	370
		Channel frames	320 × 100 × 100 × 15,5 / 17,5	340 × 100 × 100 × 14,5 / 18	340 × 100 × 100 × 17 / 18	340 × 100 × 100 × 18 / 18
12,2	840	Frames	230 × 100 × 13,5	240 × 100 × 13	240 × 100 × 14,5	240 × 100 × 15,5
		Reversed frames	225 × 100 × 14	225 × 100 × 13	225 × 100 × 14,5	225 × 100 × 15,5
		Depth of framing	355	370	370	370
		Channel frames	340 × 100 × 100 × 13,5 / 18	340 × 100 × 100 × 14,5 / 17	340 × 100 × 100 × 17,5 / 18	—
12,5	850	Frames	240 × 100 × 13	240 × 100 × 14	240 × 100 × 15	240 × 100 × 16,5
		Reversed frames	225 × 100 × 13	225 × 100 × 14	225 × 100 × 15	225 × 100 × 16,5
		Depth of framing	370	370	370	370
		Channel frames	340 × 100 × 100 × 14,5 / 17	340 × 100 × 100 × 17 / 18	340 × 100 × 100 × 18 / 18	—
12,8	865	Frames	240 × 100 × 13,5	240 × 100 × 14,5	240 × 100 × 16	
		Reversed frames	225 × 100 × 13,5	225 × 100 × 14,5	225 × 100 × 16	
		Depth of framing	370	370	370	
		Channel frames	340 × 100 × 100 × 16,5 / 18	340 × 100 × 100 × 17,5 / 18	—	
13,1	875	Frames	240 × 100 × 14	240 × 100 × 15,5		
		Reversed frames	225 × 100 × 14	225 × 100 × 15,5		
		Depth of framing	370	370		
		Channel frames	340 × 100 × 100 × 17 / 18	—		
13,4	890	Frames	240 × 100 × 15	240 × 100 × 16,5		
		Reversed frames	225 × 100 × 15	225 × 100 × 16,5		
		Depth of framing	370	370		
		Channel frames	340 × 100 × 100 × 18 / 18	—		
13,7	900	Frames	240 × 100 × 15,5			
		Reversed frames	225 × 100 × 15,5			
		Depth of framing	370			
		Channel frames	—			
14,0	915	Frames				
		Reversed frames				
		Depth of framing				
		Channel frames				

SIDE FRAMING.

COMPLETE SUPERSTRUCTURE VESSELS.

TABLE 4

(SEE CONTINUATION.)

D	FRAME SPACING.	TYPE OF FRAMING.	FRAMING IN PEAKS.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO LOWEST DECK AT SIDE.					
				Metres. 2,45	Metres. 3,05	Metres. 3,65	Metres. 3,95	Metres. 4,25	Metres. 4,55
Metres.	mm.		mm.	mm.	mm.	mm.	mm.	mm.	mm.
5,5	585	Frames	75×75×6,5	75×75× 6,5	75×75× 7				
		Reversed frames	65×65×6,5	65×65× 6,5	65×65× 7				
		Depth of framing	75	75	75				
		Angle frames	140×75×8	140×75× 8	140×75× 8,5				
5,8	595	Frames	75×75×6,5	75×75× 6,5	75×75× 7	75×75× 7			
		Reversed frames	75×65×6,5	75×65× 6,5	75×65× 7	75×75× 7			
		Depth of framing	90	90	90	90			
		Angle frames	150×75×8,5	150×75× 8,5	150×75× 9	170×75× 8,5			
6,1	595	Frames	75×75×7	75×75× 7	75×75× 8	75×75× 7,5	90×75× 7,5		
		Reversed frames	75×65×7	75×65× 7	75×65× 8	75×75× 7,5	75×75× 7,5		
		Depth of framing	90	90	90	90	100		
		Angle or bulb angle frames	150×75×9	150×75× 9	170×75× 8	170×75× 9,5	140×75× 8,5		
6,4	610	Frames	75×75×7	75×75× 7	75×75× 8	90×75× 7,5	90×75× 7,5	90×75× 8	
		Reversed frames	75×75×7	75×75× 7	75×75× 8	75×75× 7,5	90×75× 7,5	90×75× 8	
		Depth of framing	90	90	90	100	115	115	
		Angle or bulb angle frames	170×75×8,5	170×75× 8,5	140×75× 7	140×75× 8,5	150×75× 8,5	150×75×10	
6,7	610	Frames	75×75×7,5	75×75× 8	75×75× 8,5	90×75× 8	90×75× 8	90×75× 8,5	100×75× 8,5
		Reversed frames	75×75×7,5	75×75× 8	75×75× 8,5	75×75× 8	90×75× 8	90×75× 8,5	90×75× 9
		Depth of framing	90	90	90	100	115	115	125
		Angle or bulb angle frames	170×75×9,5	140×75× 7	140×75× 8	140×75×10	150×75×10	150×75×11	170×75× 9,5
7,0	620	Frames	75×75×8	90×75× 8	90×75× 8,5	100×75× 8	100×75× 8	100×75× 8,5	100×75× 9
		Reversed frames	75×75×8	75×75× 8	75×75× 8,5	75×75× 8,5	90×75× 8,5	90×75× 9	100×75× 9
		Depth of framing	90	100	100	115	125	125	140
		Bulb angle frames	140×75×7	140×75×10	150×75× 8	150×75×10	170×75× 8,5	170×75× 9,5	180×75× 9
7,3	635	Frames	75×75×8	90×75× 8,5	90×75× 9	100×75× 8,5	100×75× 8,5	100×75× 9	100×75× 9,5
		Reversed frames	75×75×8	75×75× 8,5	75×75× 9	75×75× 9	90×75× 9	90×75× 9,5	100×75× 9,5
		Depth of framing	90	100	100	115	125	125	140
		Bulb angle frames	140×75×7	150×75× 8	150×75× 9	150×75×11	170×75× 9,5	170×75×11	180×75×10
7,6	650	Frames	75×75×8,5	90×75× 8,5	90×75× 9	100×75× 8,5	100×75× 9	100×75× 9,5	120×75× 9
		Reversed frames	75×75×8,5	90×75× 8,5	90×75× 9	90×75× 9	100×75× 9	100×75× 9,5	100×75× 9,5
		Depth of framing	90	115	115	125	140	140	150
		Bulb angle frames	140×75×8	150×75×11	170×75× 8	170×75× 9,5	180×75× 9	180×75×10	190×75× 9

SIDE FRAMING.

COMPLETE SUPERSTRUCTURE VESSELS.

TABLE 4

(SEE CONTINUATION.)

D	FRAME SPACING.	TYPE OF FRAMING.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO LOWEST DECK AT SIDE.									
			Metres. 4,9	Metres. 5,2	Metres. 5,5	Metres. 5,8	Metres. 6,1	Metres. 6,4	Metres 6,7	Metres. 7,0	Metres. 7,3	Metres. 7,6
Metres.	mm.		mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm	mm.	mm.
5,5	585	Frames										
		Reversed frames										
		Depth of framing										
		Angle frames										
5,8	595	Frames										
		Reversed frames										
		Depth of framing										
		Angle frames										
6,1	595	Frames										
		Reversed frames										
		Depth of framing										
		Bulb angle frames										
6,4	610	Frames										
		Reversed frames										
		Depth of framing										
		Bulb angle frames										
6,7	610	Frames										
		Reversed frames										
		Depth of framing										
		Bulb angle frames										
7,0	620	Frames	120 × 75 × 8,5									
		Reversed frames	100 × 75 × 9									
		Depth of framing	150									
		Bulb angle frames	180 × 75 × 11,5									
7,3	635	Frames	120 × 75 × 9	120 × 75 × 10								
		Reversed frames	100 × 75 × 9,5	120 × 75 × 10								
		Depth of framing	150	150								
		Bulb angle frames	190 × 75 × 9	190 × 75 × 11								
7,6	650	Frames	120 × 75 × 10	130 × 75 × 10	130 × 75 × 10							
		Reversed frames	120 × 75 × 10	120 × 75 × 10	130 × 75 × 10							
		Depth of framing	150	165	180							
		Bulb angle frames	190 × 75 × 11	200 × 75 × 10,5	200 × 75 × 13,5							

SIDE FRAMING.

COMPLETE SUPERSTRUCTURE VESSELS.

TABLE 4

(SEE CONTINUATION.)

D	FRAME SPACING.	TYPE OF FRAMING.	FRAMING IN PEAKS.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO LOWEST DECK AT SIDE.				
				Metres. 2,45	Metres. 3,05	Metres. 3,65	Metres. 3,95	Metres. 4,25
Metres.	mm.		mm.	mm.	mm.	mm.	mm.	mm.
7,9	660	Frames	90×75× 7,5	90×75× 9	100×75× 8,5	100×75× 9	120×75× 9	120×75× 9,5
		Reversed frames	75×75× 7,5	90×75× 9	90×75× 9	90×75× 9,5	90×75× 9	100×75×10
		Depth of framing	100	115	125	125	140	140
		Bulb angle frames	140×75× 8,5	170×75× 8	170×75× 9,5	170×75×11	180×75×10	180×75×11
8,25	675	Frames	90×75× 8	100×75× 8,5	100×75× 9	120×75× 8,5	120×75× 9	120×75× 9,5
		Reversed frames	75×75× 8	90×75× 9	90×75× 9,5	90×75× 8,5	100×75× 9,5	120×75× 9,5
		Depth of framing	100	125	125	140	150	150
		Bulb angle frames	140×75×10	170×75× 9,5	170×75×11	180×75× 9	190×75× 9	190×75×10
8,55	685	Frames	90×75× 8,5	100×75× 9	100×75×10	120×75× 9,5	120×75× 9,5	120×75×10
		Reversed frames	75×75× 8,5	90×75× 9,5	100×75×10	100×75×10	120×75× 9,5	120×75×10
		Depth of framing	100	125	125	140	150	150
		Bulb angle frames	150×75× 8	170×75×11	180×75× 9	180×75×11	190×75×10	190×75×11
8,85	695	Frames	100×75× 8	120×90× 9	120×90× 9,5	120×90× 9,5	130×90× 9,5	130×90× 9,5
		Reversed frames	75×75× 8,5	90×75× 9	100×75×10	120×75× 9,5	120×75× 9,5	120×75× 9,5
		Depth of framing	115	140	140	150	165	165
		Bulb angle frames	150×75×10	180×85×10	180×85×11	190×85×10,5	200×85×10	200×85×10
9,15	710	Frames	100×75× 8,5	120×90× 9,5	120×90× 9,5	120×90× 9,5	130×90× 9,5	130×90×10
		Reversed frames	75×75× 9	100×75×10	120×75× 9,5	120×75× 9,5	120×75× 9,5	120×75×10
		Depth of framing	115	140	150	150	165	165
		Bulb angle frames	150×75×11	180×85×11	190×85×10,5	190×85×10,5	200×85×10	200×85×10,5
9,45	725	Frames	120×75× 8,5	120×90× 9,5	120×90×10	120×90×10,5	130×90×10	130×90×10
		Reversed frames	75×75× 8,5	120×75× 9,5	120×75×10	120×75×10,5	120×75×10	130×75×10
		Depth of framing	125	150	150	150	165	180
		Bulb angle frames	170×75× 9,5	190×85×10,5	190×85×11,5	200×85×10	200×85×10,5	220×85×10
9,75	735	Frames	120×75× 9	120×90×10	120×90×10,5	120×90×11	130×90×10,5	130×90×10,5
		Reversed frames	75×75× 9	120×75×10	120×75×10,5	120×75×11	120×75×10,5	130×75×10,5
		Depth of framing	125	150	150	150	165	180
		Bulb angle frames	170×75×11	190×85×11	200×85×10	200×85×10,5	200×85×11,5	220×85×10,5

SIDE FRAMING.

COMPLETE SUPERSTRUCTURE VESSELS.

TABLE 4

(SEE CONTINUATION.)

D	FRAME SPACING.	TYPE OF FRAMING.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO LOWEST DECK AT SIDE.					
			Metres. 4,55	Metres. 4,9	Metres. 5,2	Metres. 5,5	Metres. 5,8	Metres. 6,1
Metres.	mm.		mm	mm.	mm.	mm.	mm.	mm.
7,9	660	Frames	120 × 75 × 9,5	120 × 75 × 10,5	130 × 75 × 10,5	130 × 75 × 10,5		
		Reversed frames	120 × 75 × 9,5	120 × 75 × 10,5	120 × 75 × 10,5	130 × 75 × 10,5		
		Depth of framing	150	150	165	180		
		Bulb angle frames	190 × 75 × 10	200 × 75 × 10	200 × 75 × 11,5	220 × 75 × 10,5		
8,25	675	Frames	130 × 75 × 9,5	130 × 75 × 10,5	130 × 75 × 10,5	140 × 75 × 10,5	140 × 75 × 10,5	
		Reversed frames	120 × 75 × 9,5	120 × 75 × 10,5	130 × 75 × 10,5	130 × 75 × 10,5	140 × 75 × 10,5	
		Depth of framing	165	165	180	190	205	
		Bulb angle frames	200 × 75 × 10	200 × 75 × 11,5	220 × 75 × 10,5	220 × 75 × 13	220 × 75 × 14	
8,55	685	Frames	130 × 75 × 10	130 × 75 × 11	130 × 75 × 11	140 × 75 × 11	140 × 75 × 11,5	150 × 75 × 11,5
		Reversed frames	120 × 75 × 10	120 × 75 × 11	130 × 75 × 11	130 × 75 × 11	140 × 75 × 11,5	140 × 75 × 12
		Depth of framing	165	165	180	190	205	215
		Bulb angle frames	200 × 75 × 10,5	220 × 75 × 9,5	220 × 75 × 11,5	230 × 90 × 10,5	240 × 90 × 11	240 × 90 × 12,5
8,85	695	Frames	130 × 90 × 9,5	130 × 90 × 10,5	140 × 90 × 10,5	140 × 90 × 10,5	140 × 90 × 12	150 × 90 × 11
		Reversed frames	130 × 75 × 9,5	130 × 75 × 10,5	130 × 75 × 10,5	140 × 75 × 10,5	140 × 75 × 12	140 × 90 × 12
		Depth of framing	180	180	190	205	205	215
		Bulb angle frames	200 × 85 × 12	220 × 85 × 10,5	220 × 85 × 13	230 × 90 × 11,5	240 × 90 × 11,5	250 × 90 × 12
9,15	710	Frames	130 × 90 × 10	130 × 90 × 11	140 × 90 × 11	140 × 90 × 11	150 × 90 × 10,5	150 × 90 × 11,5
		Reversed frames	130 × 75 × 10	130 × 75 × 11	130 × 75 × 11	140 × 75 × 11	140 × 90 × 11	140 × 90 × 12
		Depth of framing	180	180	190	205	215	215
		Bulb angle frames	220 × 85 × 9,5	220 × 85 × 11,5	230 × 90 × 10,5	230 × 90 × 12,5	240 × 90 × 13	250 × 90 × 13
9,45	725	Frames	130 × 90 × 11	140 × 90 × 11	140 × 90 × 11	140 × 90 × 11	150 × 90 × 11	170 × 90 × 11
		Reversed frames	130 × 75 × 11	130 × 75 × 11	140 × 75 × 11	140 × 90 × 11	140 × 90 × 11,5	140 × 90 × 11
		Depth of framing	180	190	205	205	215	230
		Bulb angle frames	220 × 85 × 12	230 × 90 × 10,5	230 × 90 × 12,5	240 × 90 × 12	250 × 90 × 12	250 × 90 × 14
9,75	735	Frames	140 × 90 × 10,5	140 × 90 × 11,5	140 × 90 × 11,5	140 × 90 × 11,5	150 × 90 × 11,5	170 × 90 × 11,5
		Reversed frames	130 × 75 × 10,5	130 × 75 × 11,5	140 × 75 × 11,5	140 × 90 × 11,5	140 × 90 × 12	140 × 90 × 11,5
		Depth of framing	190	190	205	205	215	230
		Bulb angle frames	220 × 85 × 13	230 × 90 × 11,5	240 × 90 × 11	240 × 90 × 13	250 × 90 × 13	270 × 90 × 11,5

SIDE FRAMING.

COMPLETE SUPERSTRUCTURE VESSELS.

TABLE 4

(SEE CONTINUATION.)

D	FRAME SPACING.	TYPE OF FRAMING.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO LOWEST DECK AT SIDE.				
			Metres. 6,4	Metres. 6,7	Metres. 7,0	Metres. 7,3	Metres. 7,6
Metres.	mm.		mm.	mm.	mm.	mm.	mm.
7,9	660	Frames					
		Reversed frames					
		Depth of framing					
		Bulb angle frames					
8,25	675	Frames					
		Reversed frames					
		Depth of framing					
		Bulb angle frames					
8,55	685	Frames					
		Reversed frames					
		Depth of framing					
		Bulb angle frames					
8,85	695	Frames	150 × 90 × 11,5				
		Reversed frames	150 × 90 × 11,5				
		Depth of framing	230				
		Bulb angle frames	270 × 90 × 11				
9,15	710	Frames	150 × 90 × 12	170 × 90 × 11,5			
		Reversed frames	150 × 90 × 12	150 × 90 × 12			
		Depth of framing	230	240			
		Bulb angle frames	270 × 90 × 12	270 × 90 × 13,5			
9,45	725	Frames	170 × 90 × 11,5	170 × 90 × 11,5	180 × 90 × 11,5		
		Reversed frames	150 × 90 × 12	170 × 90 × 11,5	170 × 90 × 11,5		
		Depth of framing	240	255	255		
		Bulb angle frames	270 × 90 × 13,5	280 × 90 × 12,5	290 × 90 × 12,5		
9,75	735	Frames	170 × 90 × 12	170 × 90 × 12	180 × 90 × 12	180 × 90 × 12	
		Reversed frames	150 × 90 × 12,5	170 × 90 × 12	170 × 90 × 12	180 × 90 × 12	
		Depth of framing	240	255	265	280	
		Bulb angle frames	280 × 90 × 11,5	280 × 90 × 14	290 × 90 × 13	300 × 95 × 12,5	

SIDE FRAMING.

COMPLETE SUPERSTRUCTURE VESSELS.

TABLE 4

(SEE CONTINUATION.)

D	FRAME SPACING.	TYPE OF FRAMING.	FRAMING IN PEAKS.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO LOWEST DECK AT SIDE.			
				Metres. 2,45	Metres. 3,05	Metres. 3,65	Metres. 3,95
Metres.	mm.		mm.	mm.	mm.	mm.	mm.
10,0	750	Frames	130 × 75 × 8,5	130 × 90 × 9,5	130 × 90 × 10	130 × 90 × 10,5	130 × 90 × 10,5
		Reversed frames	75 × 75 × 8,5	120 × 75 × 9,5	120 × 75 × 10	120 × 75 × 10,5	130 × 75 × 10,5
		Depth of framing	140	165	165	165	180
		Bulb angle frames	180 × 75 × 9	200 × 85 × 10	200 × 85 × 10,5	200 × 85 × 11,5	220 × 85 × 10,5
10,35	760	Frames	130 × 75 × 9	130 × 90 × 9,5	130 × 90 × 9,5	130 × 90 × 10	130 × 90 × 11
		Reversed frames	75 × 75 × 9	130 × 75 × 9,5	130 × 75 × 9,5	130 × 75 × 10	130 × 75 × 11
		Depth of framing	140	180	180	180	180
		Bulb angle frames	180 × 75 × 10	200 × 85 × 12	200 × 85 × 12	200 × 85 × 13,5	220 × 85 × 11,5
10,65	775	Frames	130 × 75 × 9,5	130 × 90 × 9,5	130 × 90 × 10	140 × 90 × 9,5	140 × 90 × 9,5
		Reversed frames	90 × 75 × 9,5	130 × 75 × 9,5	130 × 75 × 10	130 × 75 × 9,5	140 × 75 × 9,5
		Depth of framing	140	180	180	190	205
		Bulb angle frames	180 × 75 × 11	200 × 85 × 12	200 × 85 × 13,5	220 × 85 × 11	220 × 85 × 13
10,95	785	Frames	140 × 90 × 9	130 × 90 × 10	140 × 90 × 9,5	140 × 90 × 10,5	140 × 90 × 10
		Reversed frames	90 × 75 × 9	130 × 75 × 10	130 × 75 × 9,5	130 × 75 × 10,5	140 × 75 × 10
		Depth of framing	150	180	190	190	205
		Bulb angle frames	190 × 85 × 9,5	200 × 85 × 13,5	220 × 85 × 11	220 × 85 × 13	230 × 90 × 10,5
11,3	800	Frames	140 × 90 × 9,5	140 × 90 × 10	140 × 90 × 10,5	140 × 90 × 11	140 × 90 × 10,5
		Reversed frames	90 × 75 × 9,5	130 × 75 × 10	130 × 75 × 10,5	130 × 75 × 11	140 × 75 × 10,5
		Depth of framing	150	190	190	190	205
		Bulb angle frames	190 × 85 × 10,5	220 × 85 × 12	220 × 85 × 13	230 × 90 × 10,5	230 × 90 × 11,5
11,6	815	Frames	140 × 90 × 10	140 × 90 × 10,5	150 × 90 × 10	150 × 90 × 10,5	150 × 90 × 10
		Reversed frames	90 × 75 × 10	130 × 75 × 10,5	130 × 75 × 10,5	130 × 75 × 11	130 × 90 × 10,5
		Depth of framing	150	190	205	205	205
		Bulb angle frames	190 × 85 × 11,5	220 × 85 × 13	230 × 90 × 10,5	230 × 90 × 11,5	240 × 90 × 10,5
11,9	825	Frames	150 × 90 × 10	150 × 90 × 10,5	150 × 90 × 11	150 × 90 × 10,5	150 × 90 × 10
		Reversed frames	90 × 75 × 10,5	130 × 75 × 11	130 × 75 × 11,5	140 × 75 × 11	140 × 90 × 10,5
		Depth of framing	165	205	205	215	215
		Bulb angle frames	200 × 85 × 10,5	230 × 90 × 11,5	240 × 90 × 10	240 × 90 × 11	240 × 90 × 12

SIDE FRAMING.

COMPLETE SUPERSTRUCTURE VESSELS.

TABLE 4

(SEE CONTINUATION.)

D	FRAME SPACING.	TYPE OF FRAMING.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO LOWEST DECK AT SIDE.				
			Metres. 4,25	Metres. 4,55	Metres. 4,9	Metres. 5,2	Metres. 5,5
Metres.	mm.		mm.	mm.	mm.	mm.	mm.
10,0	750	Frames	140 × 90 × 10	140 × 90 × 10,5	140 × 90 × 11	140 × 90 × 11	150 × 90 × 11
		Reversed frames	130 × 75 × 10	140 × 75 × 10,5	140 × 75 × 11	140 × 90 × 11	140 × 90 × 11,5
		Depth of framing	190	205	205	205	215
		Bulb angle frames	220 × 85 × 12	230 × 90 × 11,5	230 × 90 × 12,5	240 × 90 × 12	250 × 90 × 12
10,35	760	Frames	140 × 90 × 10,5	140 × 90 × 11	140 × 90 × 10,5	150 × 90 × 10,5	150 × 90 × 11,5
		Reversed frames	130 × 75 × 10,5	140 × 75 × 11	140 × 90 × 10,5	140 × 90 × 11	140 × 90 × 12
		Depth of framing	190	205	205	215	215
		Bulb angle frames	220 × 85 × 13	230 × 90 × 12,5	240 × 90 × 11,5	240 × 90 × 13	250 × 90 × 13
10,65	775	Frames	140 × 90 × 10	140 × 90 × 10	150 × 90 × 10	150 × 90 × 11	170 × 90 × 11
		Reversed frames	140 × 75 × 10	140 × 90 × 10	140 × 90 × 10,5	140 × 90 × 11,5	140 × 90 × 11
		Depth of framing	205	205	215	215	230
		Bulb angle frames	230 × 90 × 10,5	240 × 90 × 10,5	240 × 90 × 12	250 × 90 × 12	250 × 90 × 14
10,95	785	Frames	140 × 90 × 10,5	140 × 90 × 10,5	150 × 90 × 10,5	150 × 90 × 11,5	170 × 90 × 11,5
		Reversed frames	140 × 75 × 10,5	140 × 90 × 10,5	140 × 90 × 11	140 × 90 × 12	140 × 90 × 11,5
		Depth of framing	205	205	215	215	230
		Bulb angle frames	230 × 90 × 11,5	240 × 90 × 11,5	250 × 90 × 11	250 × 90 × 13	270 × 90 × 11,5
11,3	800	Frames	140 × 90 × 10	150 × 90 × 10	150 × 90 × 11	150 × 90 × 11,5	170 × 90 × 11,5
		Reversed frames	140 × 90 × 10	140 × 90 × 10,5	140 × 90 × 11,5	150 × 90 × 11,5	150 × 90 × 12
		Depth of framing	205	215	215	230	240
		Bulb angle frames	240 × 90 × 10,5	240 × 90 × 12	250 × 90 × 12	250 × 90 × 14	270 × 90 × 13,5
11,6	815	Frames	150 × 90 × 10	150 × 90 × 10,5	150 × 90 × 11,5	150 × 90 × 12	170 × 90 × 12
		Reversed frames	140 × 90 × 10,5	140 × 90 × 11	150 × 90 × 11,5	150 × 90 × 12	150 × 90 × 12,5
		Depth of framing	215	215	230	230	240
		Bulb angle frames	240 × 90 × 12	250 × 90 × 11	250 × 90 × 14	270 × 90 × 11,5	280 × 90 × 11,5
11,9	825	Frames	150 × 90 × 10,5	150 × 90 × 11	150 × 90 × 12	170 × 90 × 11,5	180 × 90 × 11,5
		Reversed frames	140 × 90 × 11	150 × 90 × 11	150 × 90 × 12	150 × 90 × 12	150 × 90 × 12
		Depth of framing	215	230	230	240	255
		Bulb angle frames	250 × 90 × 11	250 × 90 × 13	270 × 90 × 11,5	270 × 90 × 13,5	280 × 90 × 12,5

SIDE FRAMING.

COMPLETE SUPERSTRUCTURE VESSELS.

TABLE 4

(SEE CONTINUATION.)

D	FRAME PACING.	TYPE OF FRAMING.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO LOWEST DECK AT SIDE.			
			Metres. 5,8	Metres. 6,1	Metres. 6,4	Metres. 6,7
Metres.	mm.		mm.	mm.	mm.	mm.
10,0	750	Frames	150 × 90 × 11,5	170 × 90 × 11,5	170 × 90 × 11,5	180 × 90 × 12
		Reversed frames	150 × 90 × 11,5	150 × 90 × 12	170 × 90 × 11,5	170 × 90 × 12
		Depth of framing	230	240	255	265
		Bulb angle frames	250 × 90 × 14	270 × 90 × 13,5	280 × 90 × 12,5	290 × 90 × 13
10,35	760	Frames	150 × 90 × 12	170 × 90 × 12	170 × 90 × 12	180 × 90 × 12,5
		Reversed frames	150 × 90 × 12	150 × 90 × 12,5	170 × 90 × 12	170 × 90 × 12,5
		Depth of framing	230	240	255	265
		Bulb angle frames	270 × 90 × 11,5	280 × 90 × 11,5	290 × 90 × 14	290 × 90 × 14,5
10,65	775	Frames	170 × 90 × 11	170 × 90 × 11	180 × 90 × 11,5	200 × 90 × 11,5
		Reversed frames	150 × 90 × 11,5	170 × 90 × 11	170 × 90 × 11,5	170 × 90 × 12
		Depth of framing	240	255	265	280
		Bulb angle frames	270 × 90 × 12,5	280 × 90 × 12,5	290 × 90 × 12,5	300 × 95 × 12,5
10,95	785	Frames	170 × 90 × 12	170 × 90 × 12	180 × 90 × 12,5	200 × 90 × 11,5
		Reversed frames	150 × 90 × 12,5	170 × 90 × 12	170 × 90 × 12,5	180 × 90 × 12
		Depth of framing	240	255	265	290
		Bulb angle frames	280 × 90 × 11,5	280 × 90 × 14	290 × 90 × 14,5	300 × 95 × 14,5
11,3	800	Frames	180 × 90 × 11,5	180 × 90 × 12	200 × 90 × 11,5	200 × 90 × 12
		Reversed frames	150 × 90 × 12	170 × 90 × 12	170 × 90 × 12	180 × 90 × 12,5
		Depth of framing	255	265	280	290
		Bulb angle frames	280 × 90 × 12,5	290 × 90 × 13	290 × 90 × 15,5	300 × 95 × 16
11,6	815	Frames	180 × 90 × 12	180 × 90 × 12,5	200 × 90 × 12	200 × 90 × 12,5
		Reversed frames	150 × 90 × 12,5	170 × 90 × 12,5	170 × 90 × 12,5	200 × 90 × 12,5
		Depth of framing	255	265	280	290
		Bulb angle frames	280 × 90 × 14	290 × 90 × 14,5	300 × 95 × 13,5	300 × 95 × 17
11,9	825	Frames	180 × 90 × 12	200 × 90 × 11,5	200 × 90 × 12	200 × 90 × 12,5
		Reversed frames	170 × 90 × 12	170 × 90 × 12	180 × 90 × 12,5	200 × 90 × 13
		Depth of framing	265	280	290	305
		Bulb, angle or channel frames	290 × 90 × 13	300 × 95 × 12,5	300 × 95 × 16	280 × 100 × 100 × 13,5/16,5

SIDE FRAMING.

COMPLETE SUPERSTRUCTURE VESSELS.

TABLE 4

(SEE CONTINUATION.)

D	FRAME SPACING.	TYPE OF FRAMING.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO LOWEST DECK AT SIDE.			
			Metres. 7,0	Metres. 7,3	Metres. 7,6	Metres. 7,9
Metres.	mm.		mm.	mm.	mm.	mm.
10,0	750	Frames	$180 \times 90 \times 12$	$200 \times 90 \times 11,5$		
		Reversed frames	$180 \times 90 \times 12$	$180 \times 90 \times 12$		
		Depth of framing	280	290		
		Bulb angle frames	$300 \times 95 \times 12,5$	$300 \times 95 \times 14,5$		
10,35	760	Frames	$180 \times 90 \times 12,5$	$200 \times 90 \times 12$		
		Reversed frames	$180 \times 90 \times 12,5$	$180 \times 90 \times 12,5$		
		Depth of framing	280	290		
		Bulb angle frames	$300 \times 95 \times 13,5$	$300 \times 95 \times 16$		
10,65	775	Frames	$200 \times 90 \times 11,5$	$200 \times 90 \times 12$	$200 \times 90 \times 12,5$	
		Reversed frames	$180 \times 90 \times 12$	$180 \times 90 \times 12,5$	$200 \times 90 \times 12,5$	
		Depth of framing	290	305	315	
		Bulb angle or channel frames	$300 \times 95 \times 14,5$	$300 \times 95 \times 17$	$280 \times 100 \times 100 \times \frac{15}{16,5}$	
10,95	785	Frames	$200 \times 90 \times 12$	$200 \times 90 \times 13$	$225 \times 90 \times 12$	$230 \times 100 \times 13$
		Reversed frames	$180 \times 90 \times 12,5$	$200 \times 90 \times 13$	$180 \times 90 \times 12,5$	$200 \times 90 \times 13,5$
		Depth of framing	290	305	330	345
		Bulb angle or channel frames	$300 \times 90 \times 16$	$280 \times 100 \times 100 \times \frac{14,5}{16,5}$	$300 \times 100 \times 100 \times \frac{13,5}{17}$	$320 \times 100 \times 100 \times \frac{13}{17,5}$
11,3	800	Frames	$200 \times 90 \times 12,5$	$200 \times 90 \times 13,5$	$225 \times 90 \times 12,5$	$230 \times 100 \times 13,5$
		Reversed frames	$180 \times 90 \times 13$	$200 \times 90 \times 13,5$	$200 \times 90 \times 12,5$	$200 \times 90 \times 14$
		Depth of framing	305	315	345	345
		Channel frames	$280 \times 100 \times 100 \times \frac{13,5}{16,5}$	$300 \times 100 \times 100 \times \frac{13}{17}$	$320 \times 100 \times 100 \times \frac{12,5}{17,5}$	$320 \times 100 \times 100 \times \frac{13,5}{17,5}$
11,6	815	Frames	$200 \times 90 \times 13$	$200 \times 90 \times 14$	$230 \times 100 \times 13$	$230 \times 100 \times 13$
		Reversed frames	$200 \times 90 \times 13$	$200 \times 90 \times 14$	$200 \times 90 \times 13,5$	$225 \times 90 \times 13,5$
		Depth of framing	305	315	345	355
		Channel frames	$280 \times 100 \times 100 \times \frac{14,5}{16,5}$	$300 \times 100 \times 100 \times \frac{14}{17}$	$320 \times 100 \times 100 \times \frac{13}{17,5}$	$340 \times 100 \times 100 \times \frac{13}{18}$
11,9	825	Frames	$200 \times 90 \times 13,5$	$230 \times 100 \times 12,5$	$230 \times 100 \times 13,5$	$230 \times 100 \times 13,5$
		Reversed frames	$200 \times 90 \times 13,5$	$200 \times 90 \times 13$	$200 \times 90 \times 14$	$225 \times 90 \times 14$
		Depth of framing	315	345	345	355
		Channel frames	$300 \times 100 \times 100 \times \frac{13}{17}$	$300 \times 100 \times 100 \times \frac{12,5}{17,5}$	$320 \times 100 \times 100 \times \frac{13,5}{17,5}$	$340 \times 100 \times 100 \times \frac{13,5}{18}$

SIDE FRAMING.

COMPLETE SUPERSTRUCTURE VESSELS.

TABLE 4

(SEE CONTINUATION.)

D	FRAME SPACING.	TYPE OF FRAMING.	FRAMING IN PEAKS.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO LOWEST DECK AT SIDE.			
				Metres. 2,45	Metres. 3,05	Metres. 3,65	Metres. 3,95
Metres.	mm.		mm.	mm.	mm.	mm.	mm.
12,2	840	Frames	150 × 90 × 10,5	170 × 90 × 10	170 × 90 × 10,5	170 × 90 × 11	170 × 90 × 10,5
		Reversed frames	90 × 75 × 11	130 × 75 × 10	130 × 75 × 10,5	130 × 75 × 11	130 × 90 × 10,5
		Depth of framing	165	215	215	215	215
		Bulb angle frames	200 × 85 × 11,5	230 × 90 × 13	240 × 90 × 11	240 × 90 × 12	250 × 90 × 11
12,5	850	Frames	170 × 90 × 10,5	170 × 90 × 11	170 × 90 × 11,5	170 × 90 × 12	170 × 90 × 11
		Reversed frames	90 × 75 × 10,5	130 × 75 × 11	130 × 75 × 11,5	130 × 75 × 12	130 × 90 × 11
		Depth of framing	180	215	215	215	215
		Bulb angle frames	220 × 85 × 10,5	240 × 90 × 12	240 × 90 × 12,5	250 × 90 × 11,5	250 × 90 × 12
12,8	865	Frames	180 × 90 × 10,5	180 × 90 × 10,5	180 × 90 × 11	180 × 90 × 11,5	180 × 90 × 12
		Reversed frames	90 × 75 × 10,5	120 × 90 × 10,5	120 × 90 × 11	120 × 90 × 11,5	120 × 90 × 12
		Depth of framing	190	215	215	215	215
		Bulb angle frames	220 × 85 × 13	240 × 90 × 13	250 × 90 × 12	250 × 90 × 13	250 × 90 × 14
13,1	875	Frames	200 × 90 × 10	200 × 90 × 10,5	200 × 90 × 10	200 × 90 × 10,5	200 × 90 × 11
		Reversed frames	90 × 75 × 10,5	100 × 90 × 11	120 × 90 × 10,5	120 × 90 × 11	120 × 90 × 11,5
		Depth of framing	205	215	230	230	230
		Bulb angle frames	230 × 90 × 11,5	250 × 90 × 12	250 × 90 × 13	250 × 90 × 14	270 × 90 × 11,5
13,4	890	Frames	200 × 90 × 10	200 × 90 × 10,5	200 × 90 × 11	200 × 90 × 11,5	200 × 90 × 11
		Reversed frames	90 × 90 × 10,5	120 × 90 × 11	120 × 90 × 11,5	120 × 90 × 12	130 × 90 × 11,5
		Depth of framing	205	230	230	230	240
		Bulb angle frames	240 × 90 × 11,5	250 × 90 × 14	270 × 90 × 11,5	270 × 90 × 12,5	270 × 90 × 13,5
13,7	900	Frames	200 × 90 × 10,5	200 × 90 × 11,5	200 × 90 × 11	200 × 90 × 11,5	200 × 90 × 11
		Reversed frames	90 × 90 × 11	100 × 90 × 12	120 × 90 × 11,5	120 × 90 × 12	130 × 90 × 11,5
		Depth of framing	215	230	240	240	255
		Bulb angle frames	240 × 90 × 13	270 × 90 × 11,5	270 × 90 × 12,5	270 × 90 × 13,5	270 × 90 × 14,5
14,0	915	Frames	200 × 90 × 10,5	200 × 90 × 11,5	200 × 90 × 11	200 × 90 × 11,5	200 × 90 × 11
		Reversed frames	100 × 90 × 11	120 × 90 × 12	130 × 90 × 11,5	130 × 90 × 12	140 × 90 × 11,5
		Depth of framing	230	240	255	255	265
		Bulb angle frames	250 × 90 × 13	270 × 90 × 13,5	270 × 90 × 14,5	280 × 90 × 12,5	280 × 90 × 13,5

SIDE FRAMING.

COMPLETE SUPERSTRUCTURE VESSELS.

TABLE 4

(SEE CONTINUATION.)

D	FRAME SPACING.	TYPE OF FRAMING.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO LOWEST DECK AT SIDE				
			Metres. 4,25	Metres. 4,55	Metres. 4,9	Metres. 5,2	Metres. 5,5
Metres.	mm.		mm.	mm.	mm.	mm.	mm.
12,2	840	Frames	170 × 90 × 11	170 × 90 × 11	170 × 90 × 11	180 × 90 × 11	180 × 90 × 11,5
		Reversed frames	130 × 90 × 11	140 × 90 × 11	150 × 90 × 11,5	150 × 90 × 11,5	170 × 90 × 11,5
		Depth of framing	215	230	240	255	265
		Bulb angle frames	250 × 90 × 12	250 × 90 × 14	270 × 90 × 12,5	270 × 90 × 14,5	290 × 90 × 12,5
12,5	850	Frames	170 × 90 × 11,5	170 × 90 × 11,5	170 × 90 × 11,5	180 × 90 × 11,5	180 × 90 × 12
		Reversed frames	130 × 90 × 11,5	140 × 90 × 11,5	150 × 90 × 12	150 × 90 × 12	170 × 90 × 12
		Depth of framing	215	230	240	255	265
		Bulb angle frames	250 × 90 × 13	270 × 90 × 11,5	270 × 90 × 13,5	280 × 90 × 12,5	290 × 90 × 13
12,8	865	Frames	180 × 90 × 11,5	180 × 90 × 12	180 × 90 × 11	180 × 90 × 11,5	180 × 90 × 12,5
		Reversed frames	130 × 90 × 11,5	130 × 90 × 12	150 × 90 × 11,5	170 × 90 × 11,5	170 × 90 × 12,5
		Depth of framing	230	230	255	265	265
		Bulb angle frames	270 × 90 × 11,5	270 × 90 × 12,5	270 × 90 × 14,5	290 × 90 × 12,5	290 × 90 × 14,5
13,1	875	Frames	200 × 90 × 10,5	200 × 90 × 11,5	200 × 90 × 11,5	200 × 90 × 12	200 × 90 × 13
		Reversed frames	130 × 90 × 11	130 × 90 × 12	140 × 90 × 12	140 × 90 × 12,5	150 × 90 × 13
		Depth of framing	240	240	255	265	280
		Bulb angle frames	270 × 90 × 12,5	280 × 90 × 11,5	280 × 90 × 14	290 × 90 × 13	300 × 95 × 13,5
13,4	890	Frames	200 × 90 × 11	200 × 90 × 11,5	200 × 90 × 11,5	200 × 90 × 12,5	200 × 90 × 13
		Reversed frames	130 × 90 × 11,5	130 × 90 × 12	140 × 90 × 12	150 × 90 × 12,5	170 × 90 × 13
		Depth of framing	255	255	265	280	280
		Bulb angle frames	270 × 90 × 14,5	280 × 90 × 12,5	290 × 90 × 12,5	300 × 95 × 12,5	300 × 95 × 14
13,7	900	Frames	200 × 90 × 11,5	200 × 95 × 11,5	200 × 90 × 12,5	200 × 90 × 13	200 × 90 × 13
		Reversed frames	130 × 90 × 12	140 × 90 × 12	140 × 90 × 13	150 × 90 × 13	180 × 90 × 13,5
		Depth of framing	255	265	265	280	290
		Bulb angle frames	280 × 90 × 12,5	290 × 90 × 12,5	290 × 90 × 14,5	300 × 95 × 13,5	300 × 95 × 17
14,0	915	Frames	200 × 90 × 11,5	200 × 90 × 12	200 × 90 × 13	200 × 90 × 12,5	225 × 90 × 12
		Reversed frames	140 × 90 × 12	150 × 90 × 12	150 × 90 × 13	170 × 90 × 13	170 × 90 × 12,5
		Depth of framing	265	280	280	290	305
		Bulb angle or channel frames	290 × 90 × 12,5	290 × 90 × 14	300 × 95 × 13,5	300 × 95 × 16	280 × 100 × 100 × 13,5 / 16,5

SIDE FRAMING.

COMPLETE SUPERSTRUCTURE VESSELS.

TABLE 4

(SEE CONTINUATION.)

D	FRAME SPACING.	TYPE OF FRAMING.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO LOWEST DECK AT SIDE.			
			Metres. 5,8	Metres. 6,1	Metres. 6,4	Metres. 6,7
Metres.	mm.		mm.	mm.	mm.	mm.
12,2	840	Frames	$180 \times 90 \times 12,5$	$200 \times 90 \times 12,5$	$200 \times 90 \times 13$	$200 \times 90 \times 13,5$
		Reversed frames	$170 \times 90 \times 12,5$	$180 \times 90 \times 13$	$180 \times 90 \times 13,5$	$200 \times 90 \times 13,5$
		Depth of framing	265	280	290	305
		Bulb angle or channel frames	$290 \times 90 \times 14,5$	$300 \times 95 \times 14,5$	$300 \times 95 \times 17$	$280 \times 100 \times 100 \times \frac{14,5}{16,5}$
12,5	850	Frames	$180 \times 90 \times 13,5$	$200 \times 90 \times 13$	$200 \times 90 \times 13$	$225 \times 90 \times 13$
		Reversed frames	$180 \times 90 \times 13,5$	$180 \times 90 \times 13,5$	$200 \times 90 \times 13$	$200 \times 90 \times 13$
		Depth of framing	265	280	305	315
		Bulb angle or channel frames	$300 \times 95 \times 13,5$	$300 \times 95 \times 16$	$280 \times 100 \times 100 \times \frac{14,5}{16,5}$	$300 \times 100 \times 100 \times \frac{13}{17}$
12,8	865	Frames	$200 \times 90 \times 12,5$	$200 \times 90 \times 13$	$225 \times 90 \times 12,5$	$225 \times 90 \times 13$
		Reversed frames	$180 \times 90 \times 13$	$180 \times 90 \times 13,5$	$180 \times 90 \times 12,5$	$200 \times 90 \times 13,5$
		Depth of framing	280	290	315	330
		Bulb angle or channel frames	$300 \times 95 \times 14,5$	$300 \times 95 \times 17$	$280 \times 100 \times 100 \times \frac{15}{16,5}$	$300 \times 100 \times 100 \times \frac{14,5}{17}$
13,1	875	Frames	$200 \times 90 \times 12,5$	$200 \times 90 \times 13$	$225 \times 90 \times 12,5$	$225 \times 90 \times 13,5$
		Reversed frames	$170 \times 90 \times 13$	$200 \times 90 \times 13$	$200 \times 90 \times 12,5$	$200 \times 90 \times 13,5$
		Depth of framing	290	305	315	330
		Bulb angle or channel frames	$300 \times 95 \times 16$	$280 \times 100 \times 100 \times \frac{14,5}{16,5}$	$300 \times 100 \times 100 \times \frac{12,5}{17}$	$320 \times 100 \times 100 \times \frac{12,5}{17}$
13,4	890	Frames	$200 \times 90 \times 13,5$	$200 \times 90 \times 13,5$	$225 \times 90 \times 13$	$225 \times 90 \times 13$
		Reversed frames	$180 \times 90 \times 14$	$200 \times 90 \times 13,5$	$200 \times 90 \times 13$	$225 \times 90 \times 13$
		Depth of framing	290	305	330	345
		Channel frames	$280 \times 100 \times 100 \times \frac{13,5}{16,5}$	$280 \times 100 \times 100 \times \frac{15}{16,5}$	$300 \times 100 \times 100 \times \frac{14,5}{17}$	$320 \times 100 \times 100 \times \frac{13,5}{17}$
13,7	900	Frames	$225 \times 90 \times 13$	$225 \times 90 \times 13,5$	$225 \times 90 \times 13,5$	$225 \times 90 \times 13,5$
		Reversed frames	$180 \times 90 \times 13$	$200 \times 90 \times 13,5$	$200 \times 90 \times 13,5$	$225 \times 90 \times 13,5$
		Depth of framing	305	305	330	345
		Channel frames	$280 \times 100 \times 100 \times \frac{14,5}{16,5}$	$300 \times 100 \times 100 \times \frac{14}{17}$	$320 \times 100 \times 100 \times \frac{12,5}{17}$	$320 \times 100 \times 100 \times \frac{14,5}{17}$
14,0	915	Frames	$225 \times 90 \times 12,5$	$230 \times 100 \times 12,5$	$230 \times 100 \times 13,5$	$230 \times 100 \times 13$
		Reversed frames	$200 \times 90 \times 12,5$	$200 \times 90 \times 13$	$200 \times 90 \times 14$	$225 \times 90 \times 13,5$
		Depth of framing	315	330	345	355
		Channel frames	$300 \times 100 \times 100 \times \frac{13}{17}$	$300 \times 100 \times 100 \times \frac{14,5}{17}$	$320 \times 100 \times 100 \times \frac{13,5}{17}$	$340 \times 100 \times 100 \times \frac{12,5}{17}$

SIDE FRAMING.

COMPLETE SUPERSTRUCTURE VESSELS.

TABLE 4 (CONCLUDED.)

D	FRAME SPACING.	TYPE OF FRAMING.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO LOWEST DECK AT SIDE.			
			Metres. 7,0	Metres. 7,3	Metres. 7,6	Metres 7,9
Metres.	mm.		mm.	mm.	mm.	mm.
12,2	840	Frames	200 × 90 × 14	230 × 100 × 13	230 × 100 × 13	230 × 100 × 14
		Reversed frames	200 × 90 × 14	200 × 90 × 13,5	225 × 90 × 13,5	225 × 90 × 14,5
		Depth of framing	315	345	355	355
		Channel frames	$300 \times 100 \times 100 \times \frac{14}{17}$	$320 \times 100 \times 100 \times \frac{13}{17,5}$	$340 \times 100 \times 100 \times \frac{13}{18}$	$340 \times 100 \times 100 \times \frac{14,5}{18}$
12,5	850	Frames	225 × 90 × 13,5	230 × 100 × 13,5	230 × 100 × 13,5	240 × 100 × 13
		Reversed frames	200 × 90 × 14	200 × 90 × 14	225 × 90 × 14	225 × 100 × 13
		Depth of framing	330	345	355	370
		Channel frames	$320 \times 100 \times 100 \times \frac{12,5}{17}$	$320 \times 100 \times 100 \times \frac{13,5}{17}$	$340 \times 100 \times 100 \times \frac{13,5}{18}$	$340 \times 100 \times 100 \times \frac{15}{18}$
12,8	865	Frames	230 × 100 × 13,5	230 × 100 × 13	230 × 100 × 14	240 × 100 × 14
		Reversed frames	200 × 90 × 13,5	225 × 90 × 13,5	225 × 90 × 14,5	225 × 100 × 14
		Depth of framing	345	355	355	370
		Channel frames	$320 \times 100 \times 100 \times \frac{13}{17}$	$340 \times 100 \times 100 \times \frac{13}{18}$	$340 \times 100 \times 100 \times \frac{14,5}{18}$	$340 \times 100 \times 100 \times \frac{17}{18}$
13,1	875	Frames	230 × 100 × 12,5	230 × 100 × 13,5	240 × 100 × 13,5	240 × 100 × 14,5
		Reversed frames	225 × 90 × 13	225 × 90 × 14	225 × 100 × 13,5	225 × 100 × 14,5
		Depth of framing	355	355	370	370
		Channel frames	$320 \times 100 \times 100 \times \frac{14,5}{17}$	$340 \times 100 \times 100 \times \frac{13,5}{18}$	$340 \times 100 \times 100 \times \frac{16,5}{18}$	$340 \times 100 \times 100 \times \frac{17,5}{18}$
13,4	890	Frames	230 × 100 × 13	240 × 100 × 13	240 × 100 × 14	240 × 100 × 15
		Reversed frames	225 × 90 × 13,5	225 × 100 × 13	225 × 100 × 14	225 × 100 × 15
		Depth of framing	355	370	370	370
		Channel frames	$340 \times 100 \times 100 \times \frac{12,5}{17}$	$340 \times 100 \times 100 \times \frac{14,5}{17}$	$340 \times 100 \times 100 \times \frac{17}{18}$	$340 \times 100 \times 100 \times \frac{18}{18}$
13,7	900	Frames	230 × 100 × 14	240 × 100 × 13,5	240 × 100 × 15	
		Reversed frames	225 × 90 × 14,5	225 × 100 × 13,5	225 × 100 × 15	
		Depth of framing	355	370	370	
		Channel frames	$340 \times 100 \times 100 \times \frac{14}{17}$	$340 \times 100 \times 100 \times \frac{16,5}{18}$	$340 \times 100 \times 100 \times \frac{18}{18}$	
14,0	915	Frames	240 × 100 × 13	240 × 100 × 14	240 × 100 × 15,5	
		Reversed frames	225 × 100 × 13	225 × 100 × 14	225 × 100 × 15,5	
		Depth of framing	370	370	370	
		Channel frames	$340 \times 100 \times 100 \times \frac{14,5}{17}$	$340 \times 100 \times 100 \times \frac{17}{18}$	———	

T

PANTING ARRANGEMENTS.

DEEP FRAMES and INTERCOSTAL STRINGERS.

TABLE 5

(SEE CONTINUATION.)

DEPTH D			DEPTH (d) AT COLLISION BULKHEAD FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO TOP OF BEAMS AT SIDE OF LOWEST DECK.					
Full Scantling Vessels.	Complete Superstructure Vessels.		Metres. 3,05	Metres. 3,65	Metres. 4,25	Metres. 4,90	Metres. 5,50	Metres. 6,10
Metres.	Metres.		mm.	mm.	mm.	mm.	mm.	mm.
3,05	5,50	^	130 × 75 × 7	130 × 75 × 8,5	140 × 75 × 9	150 × 75 × 8,5	170 × 75 × 8,5	180 × 75 × 8
3,65	6,10		130 × 75 × 8,5	140 × 75 × 8,5	150 × 75 × 8	170 × 75 × 8,5	180 × 75 × 9	190 × 75 × 8,5
4,25	6,40		140 × 75 × 8,5	150 × 75 × 8	170 × 75 × 8	180 × 75 × 8,5	190 × 75 × 9	200 × 75 × 9,5
4,90	6,70		150 × 75 × 9	170 × 75 × 9	180 × 75 × 8,5	190 × 75 × 8,5	200 × 75 × 9,5	220 × 75 × 9
5,50	7,00		170 × 75 × 9,5	180 × 75 × 9,5	190 × 75 × 8,5	200 × 75 × 9,5	220 × 75 × 9	220 × 75 × 14
6,10	7,30		180 × 75 × 9,5	190 × 75 × 9,5	200 × 75 × 9,5	220 × 75 × 9	220 × 75 × 14	240 × 90 × 10
6,70	7,90		190 × 75 × 10	200 × 75 × 10,5	220 × 75 × 9,5	220 × 75 × 14	240 × 90 × 10	240 × 90 × 11
7,30	8,55		200 × 75 × 10,5	220 × 75 × 10	220 × 75 × 14	240 × 90 × 10	240 × 90 × 11	250 × 90 × 11,5
7,90	9,15	BULB ANGLES	220 × 75 × 10	220 × 75 × 14	240 × 90 × 10	240 × 90 × 11,5	250 × 90 × 11,5	270 × 90 × 10,5
8,55	9,75		220 × 75 × 14,5	240 × 90 × 10,5	250 × 90 × 11	250 × 90 × 12	270 × 90 × 10,5	280 × 90 × 11
9,15	10,35		240 × 90 × 10,5	250 × 90 × 11	250 × 90 × 13	270 × 90 × 11,5	280 × 90 × 11	290 × 90 × 11,5
9,75	10,95		250 × 90 × 11,5	270 × 90 × 11	270 × 90 × 12,5	280 × 90 × 12	290 × 90 × 12	300 × 90 × 12
10,35	11,60		270 × 90 × 11,5	280 × 90 × 11,5	280 × 90 × 13	290 × 90 × 13	300 × 90 × 12,5	280 × 100 × 100 × 11,5 / 16,5
10,95	12,20		280 × 90 × 11,5	290 × 90 × 12	300 × 90 × 12	300 × 90 × 13,5	280 × 100 × 100 × 12 / 16,5	300 × 100 × 100 × 11 / 17
11,60	12,80		290 × 90 × 12,5	300 × 90 × 13	280 × 100 × 100 × 11,5 / 16,5	280 × 100 × 100 × 12,5 / 16,5	300 × 100 × 100 × 12 / 17	300 × 100 × 100 × 14 / 17
12,20	13,40	v	300 × 90 × 13	280 × 100 × 100 × 13,5 / 16,5	300 × 100 × 100 × 11,5 / 16,5	300 × 100 × 100 × 13,5 / 17	300 × 100 × 100 × 15 / 17	320 × 100 × 100 × 14 / 17,5
12,80	14,00	^	280 × 100 × 100 × 13,5 / 16,5	300 × 100 × 100 × 13,5 / 17	300 × 100 × 100 × 15 / 16,5	320 × 100 × 100 × 13,5 / 17,5	320 × 100 × 100 × 14,5 / 17,5	340 × 100 × 100 × 13,5 / 18
13,40		CHANNELS	300 × 100 × 100 × 13,5 / 17	320 × 100 × 100 × 14 / 17,5	320 × 100 × 100 × 15 / 17,5	340 × 100 × 100 × 13,5 / 18	340 × 100 × 100 × 14,5 / 18	340 × 100 × 100 × 16,5 / 18
14,00		v	320 × 100 × 100 × 14 / 17,5	340 × 100 × 100 × 14,5 / 18	340 × 100 × 100 × 15,5 / 18	340 × 100 × 100 × 17 / 18	340 × 100 × 100 × 18 / 18	

PANTING ARRANGEMENTS.

DEEP FRAMES and INTERCOSTAL STRINGERS.

TABLE 5 *(CONCLUDED.)*

DEPTH D			DEPTH (d) AT COLLISION BULKHEAD FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO TOP OF BEAMS AT SIDE OF LOWEST DECK.					Thickness of Stringer Plate.	Face Bar on Stringer.
Full Scantling Vessels.	Complete Superstructure Vessels.		Metres. 6,70	Metres. 7,30	Metres. 7,90	Metres. 8,55	Metres. 9,15		
Metres.	Metres.		mm.	mm.	mm.	mm.	mm.		
3,05	5,50	BULB ANGLES						7,5	75 × 75 × 7,5
3,65	6,10		200 × 75 × 9,5					7,5	75 × 75 × 7,5
4,25	6,40		220 × 75 × 9,5					7,5	75 × 75 × 8,5
4,90	6,70		220 × 75 × 14	240 × 90 × 11,5				8	90 × 75 × 8,5
5,50	7,00		240 × 90 × 10	250 × 90 × 12	280 × 90 × 12,5			8,5	100 × 75 × 9
6,10	7,30		240 × 90 × 11,5	270 × 90 × 11,5	290 × 90 × 12,5	300 × 100 × 100 × 11/17		8,5	100 × 75 × 10
6,70	7,90		250 × 90 × 12	280 × 90 × 11,5	300 × 90 × 12,5	300 × 100 × 100 × 12,5/17	320 × 100 × 100 × 14,5/17,5	9	120 × 75 × 10
7,30	8,55		270 × 90 × 11,5	290 × 90 × 12	280 × 100 × 100 × 11,5/16,5	300 × 100 × 100 × 14/17	340 × 100 × 100 × 14/18	9,5	130 × 75 × 10
7,90	9,15		280 × 90 × 11,5	300 × 90 × 12,5	300 × 100 × 100 × 11/17	320 × 100 × 100 × 13,5/17,5	340 × 100 × 100 × 15/18	10	140 × 75 × 10
8,55	9,75		290 × 90 × 12	280 × 100 × 100 × 11/16,5	300 × 100 × 100 × 13,5/17	320 × 100 × 100 × 14,5/17,5	340 × 100 × 100 × 16,5/18	10	140 × 90 × 10,5
9,15	10,35		300 × 90 × 12,5	280 × 100 × 100 × 13,5/16,5	300 × 100 × 100 × 15,5/17	340 × 100 × 100 × 13,5/18	340 × 100 × 100 × 17,5/18	10,5	150 × 90 × 11
9,75	10,95	CHANNELS	280 × 100 × 100 × 12/16,5	300 × 100 × 100 × 13,5/17	320 × 100 × 100 × 14/17,5	340 × 100 × 100 × 15/18		11	150 × 90 × 12
10,35	11,60		300 × 100 × 100 × 11,5/17	300 × 100 × 100 × 15,5/17	340 × 100 × 100 × 13,5/18	340 × 100 × 100 × 17,5/18		11	170 × 90 × 11,5
10,95	12,20		300 × 100 × 100 × 14/17	320 × 100 × 100 × 14/17,5	340 × 100 × 100 × 15/18			11,5	180 × 90 × 12
11,60	12,80		320 × 100 × 100 × 14/17,5	340 × 100 × 100 × 13,5/18	340 × 100 × 100 × 17,5/18			12	200 × 90 × 11,5
12,20	13,40		340 × 100 × 100 × 13/18	340 × 100 × 100 × 15,5/18				12	200 × 90 × 12,5
12,80	14,00		340 × 100 × 100 × 15,5/18	340 × 100 × 100 × 18/18				12,5	200 × 90 × 13,5
13,40								12,5	225 × 90 × 13
14,00								13	230 × 100 × 13,5

DOUBLE BOTTOMS.

TABLE 6
(SEE CONTINUATION.)

FIRST LONGITUDINAL NUMERAL. L × D	CENTRE GIRDER.					MARGIN PLATE		FLOOR PLATES, SIDE GIRDERS AND BRACKETS INSIDE TANK.			INNER BOTTOM PLATING.						
	Height Above Base Line.		Thickness.			Thickness.		Thickness.			Middle Line Strake, except in Boiler Room.			Thickness.			
											Breadth.	Thickness.		In Holds.		In Engine Room.	In Boiler Room, including Middle Line Strake.
	Full Scantling Vessels.	Complete Superstructure Vessels.	Half Length Amids.	At Ends.	In Boiler Room.	In Holds and Engine Room.	In Boiler Room.	Floors in Holds and Engine Room. Side Girders in Engine Room.	Floors and Side Girders in Boiler Room.	Side Girders in Holds.		Half Length Amids.	At Ends.	Half Length Amids.	At Ends.		
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
120	685		8	6,5	10,5	7	9,5	6,5	9	6,5	940	7	6,5	6,5	6,5	7,5	10,5
155	710		8,5	7	11	7,5	10	6,5	9	6,5	965	7,5	7	7	7	8	11
195	735		9	7,5	11,5	7,5	10	7	9,5	7	990	8	7,5	7	7	8	11
240	760		9,5	8	12	8	10,5	7	9,5	7	1015	8,5	7,5	7,5	7	8,5	11,5
290	785	735	9,5	8,5	12	8,5	11	7,5	10	7	1040	8,5	8	7,5	7,5	8,5	11,5
355	815	760	10	8,5	12,5	9	11,5	7,5	10	7	1065	9	8	8	7,5	9	11,5
420	840	785	10	9	12,5	9	11,5	8	10,5	7,5	1090	9,5	8,5	8	7,5	9,5	12
490	865	815	10,5	9	13	9,5	12	8	10,5	7,5	1120	9,5	8,5	8,5	8	9,5	12
560	890	840	10,5	9	13	10	12,5	8,5	11	8	1145	10	8,5	8,5	8	10	12,5
630	915	865	11	9,5	13,5	10	12,5	8,5	11	8	1170	10,5	9	9	8,5	10,5	13
700	940	890	11,5	9,5	14	10,5	13	8,5	11	8	1195	10,5	9	9	8,5	10,5	13
775	965	915	11,5	9,5	14	10,5	13	9	11,5	8,5	1195	11	9,5	9,5	8,5	11	13
850	990	940	12	10	14,5	11	13,5	9	11,5	8,5	1220	11,5	9,5	10	8,5	11,5	13,5
930	1015	965	12	10	14,5	11,5	14	9	11,5	8,5	1245	12	10	10	9	12	13,5
1010	1040	990	12,5	10	15	12	14,5	9,5	12	9	1245	12	10	10	9	12	14
1095	1065	1015	12,5	10,5	15	12,5	14,5	9,5	12	9	1270	12,5	10	10,5	9	12,5	14
1185	1090	1040	13	11	15	12,5	14,5	10	12,5	9	1295	12,5	10,5	10,5	9,5	12,5	14
1275	1120	1065	13	11	15	13	14,5	10	12,5	9	1320	12,5	10,5	10,5	9,5	12,5	14
1380	1145	1090	13,5	11,5	15,5	13,5	15	10,5	13	9,5	1345	13	11	11	10	13	14,5
1475	1170	1120	13,5	11,5	15,5	13,5	15	10,5	13	9,5	1370	13	11	11	10	13	14,5
1580	1195	1145	14	12	16	14	15	11	13,5	10	1395	13,5	11,5	11,5	10,5	13,5	15
1690	1220	1170	14	12	16	14	15	11	13,5	10	1420	14	11,5	12	10,5	14	15,5
1810	1245	1195	14,5	12,5	16	14,5	15,5	11,5	13,5	10,5	1450	14,5	12	12,5	11	14,5	15,5
1940	1270	1220	14,5	12,5	16	15	16,5	11,5	13,5	10,5	1475	14,5	12,5	12,5	11,5	14,5	15,5
2080	1295	1245	15	13	16,5	15,5	17	12	14	11	1525	15	13	13	12	15	16,5
2230	1320	1270	15,5	13,5	17	16,5	17,5	12	14	11	1575	15,5	13	13,5	12	15,5	17
2385	1345	1295	15,5	13,5	17	17	18	12,5	14	11,5	1625	16,5	13,5	13,5	12,5	16,5	17
2555		1320	16	14	17	17,5	18,5	12,5	14	11,5	1650	17	14	14	13	16,5	17
2730		1345	16,5	14,5	17,5	17,5	18,5	12,5	14	11,5	1700	17,5	14,5	14	13	17	17,5
2920		1370	17	15	18	18	19	13	14	12	1755	18	15	14,5	13,5	17	18
3120		1395	17,5	15,5	18,5	18	19	13	14	12	1780	18	15	14,5	13,5	17	18

DOUBLE BOTTOMS.

TABLE 6
(CONCLUDED.)

FIRST LONGITUDINAL NUMERAL. L×D	DIMENSIONS OF ANGLE BARS.						
	Angles Connecting Centre Girder to Flat Plate Keel.		Angles Connecting Centre Girder to Inner Bottom.		Angles Connecting Margin Plate to Shell Plating.	Frames and Reversed* Frames on Floors, Side Girder Angles, Vertical Angles on Centre Girder and Margin Plate.	Vertical Angles Connecting Floors and Side Girders.
	Half Length Amidships.	Thickness at Ends.	Half Length Amidships.	Thickness at Ends.			
	mm.	mm.	mm.	mm.	mm.	mm.	mm.
120	75× 75× 8	8	60× 60× 7	7	75× 75× 7,5	60× 60× 6,5	60×60× 6,5
155	75× 75× 8,5	8,5	60× 60× 7,5	7,5	75× 75× 8	60× 60× 6,5	60×60× 6,5
195	75× 75× 9	9	75× 75× 8	8	75× 75× 8	75× 75× 7	65×65× 7
240	75× 75× 9,5	9	75× 75× 8,5	8,5	75× 75× 8,5	75× 75× 7	65×65× 7
290	75× 75× 9,5	9	75× 75× 8,5	8,5	75× 75× 9	75× 75× 7,5	65×65× 7
355	90× 90×10	9	75× 75× 9	8,5	75× 75× 9,5	75× 75× 7,5	65×65× 7,5
420	90× 90×10	9,5	75× 75× 9	8,5	75× 75×10	75× 75× 8	65×65× 7,5
490	90× 90×10,5	10	75× 75× 9,5	9	75× 75×10	75× 75× 8	65×65× 7,5
560	90× 90×10,5	10	75× 75× 9,5	9	75× 75×10,5	75× 75× 8,5	65×65× 8
630	90× 90×11	10	75× 75× 9,5	9	75× 75×10,5	75× 75× 8,5	65×65× 8
700	90× 90×11	10,5	75× 75×10	9,5	90× 90×11	90× 90× 8,5	65×65× 8
775	90× 90×11,5	11	75× 75×10	9,5	90× 90×11	90× 90× 9	75×75× 8,5
850	100×100×11,5	11	75× 75×10,5	10	90× 90×11,5	90× 90× 9	75×75× 8,5
930	100×100×12	11,5	75× 75×10,5	10	90× 90×12	90× 90× 9,5	75×75× 8,5
1010	100×100×12	11,5	75× 75×11	10,5	90× 90×12	90× 90×10	75×75× 9
1095	100×100×12,5	12	90× 90×11	10·5	90× 90×12,5	90× 90×10,5	75×75× 9
1185	100×100×12,5	12	90× 90×11,5	10,5	90× 90×12,5	90× 90×10,5	75×75× 9,5
1275	100×100×13	12	90× 90×11,5	10,5	90× 90×13	90× 90×10,5	75×75× 9,5
1380	100×100×13,5	12,5	90× 90×12	11	90× 90×13,5	90× 90×11	75×75×10
1475	130×130×13,5	12,5	90× 90×12	11	90× 90×13,5	90× 90×11,5	75×75×10
1580	130×130×14	13	90× 90×12,5	11,5	90× 90×14	90× 90×12	75×75×10,5
1690	130×130×14	13	90× 90×12,5	11,5	90× 90×14	90× 90×12	75×75×10,5
1810	130×130×14,5	13,5	90× 90×13	12	90× 90×14,5	90× 90×12,5	75×75×11
1940	130×130×15	13,5	90× 90×13,5	12	90× 90×15	90× 90×12,5	75×75×11
2080	130×130×15	13,5	90× 90×14	12,5	90× 90×15,5	90× 90×13	75×75×11,5
2230	130×130×15,5	14	90× 90×14,5	13	90× 90×16,5	90× 90×13	75×75×11,5
2385	130×130×15,5	14	90× 90×15	13,5	90× 90×17	90× 90×13,5	75×75×12
2555	130×130×16	14,5	100×100×15,5	13,5	100×100×17,5	100×100×14	75×75×12
2730	130×130×16,5	15	100×100×16	14	100×100×18	100×100×14	75×75×12
2920	130×130×17	15,5	100×100×16,5	14,5	100×100×18,5	100×100×14,5	75×75×12,5
3120	130×130×17,5	16	100×100×17	15	100×100×19	100×100×14,5	75×75×12,5

In the boiler room the thicknesses of angle bars not covered by cement are to be increased by 2,5 mm. beyond those given in the Table.

*Flanges of reversed frames on floors and of top angles of intercostals need not exceed 75 mm. where the thickness of the inner bottom plating does not exceed 12,5 mm. The widths of the flanges of vertical connecting angles may be as required for the diameter of rivet used.

LLOYD'S REGISTER OF SHIPPING, LONDON.—25*th October*, 1934.

BRACKET FLOORS in DOUBLE BOTTOMS.

FULL SCANTLING VESSELS.

TABLE 7

DEPTH D		UNSUPPORTED SPAN.					
		Metres. ,92	Metres. 1,22	Metres. 1,5	Metres. 1,85	Metres. 2,15	Metres. 2,45
Metres.		mm.	mm.	mm.	mm.	mm.	mm.
3,65	ANGLES	90×65× 8,5	100×65× 8,5	100×65× 9,5			
4,25	ANGLES	100×65× 8	100×65× 9	100×65× 9			
4,9	ANGLES	100×75× 8,5	115×75× 8,5	130×75× 9	150×75× 9	140×75× 9	150×75× 9
5,5	ANGLES	115×75× 8,5	130×75× 8,5	140×75× 9	170×75× 8,5	150×75× 9	170×75× 8,5
6,1	ANGLES	130×75× 8,5	140×75× 8,5	150×75× 9	140×75× 8,5	150×75×11	180×75× 8,5
6,7	ANGLES	130×90× 9	150×90× 9	170×90× 8,5	140×85×10,5	170×85× 9,5	180×85×10
7,3	ANGLES	140×90× 9	170×90× 8,5	130×85× 9,5	150×85× 9,5	180×85× 8,5	190×85×10
7,9	ANGLES	150×90× 9,5	130×85× 9	130×85×11,5	150×85×11	180×85×10	200×85×10,5
8,55	BULB ANGLES	130×85× 9	140×85× 8,5	140×85×10,5	170×85× 9	190×85× 9,5	200×85×12,5
9,15	BULB ANGLES	130×85× 9,5	140×85× 9,5	150×85×10	170×85×11	190×85×11,5	220×85×11
9,75	BULB ANGLES	130×85×10	140×85×10,5	150×85×11,5	180×85×10	200×85×10,5	220×85×13
10,35	BULB ANGLES	140×85× 9,5	150×85×10	170×85×10	180×85×12	200×85×12,5	230×90×12
10,95	BULB ANGLES	140×85×10	150×85×11,5	170×85×11,5	190×85×11,5	220×85×11	240×90×11,5
11,6	BULB ANGLES	140×85×11	170×85×10,5	180×85×10,5	200×85×10,5	220×85×13	250×90×11,5
12,2	BULB ANGLES	150×85×11	170×85×11,5	180×85×12,5	200×85×12,5	230×90×12,5	250×90×14
12,8	BULB ANGLES	150×85×11,5	180×85×10,5	190×85×11,5	220×85×11	240×90×12	270×90×12,5
13,4	BULB ANGLES	170×85×10,5	180×85×10,5	190×85×13	220×85×12,5	240×90×14	280×90×12,5
14,0	BULB ANGLES	170×85×12,5	180×85×12	200×85×12,5	230×90×11,5	250×90×14	280×90×15

COMPLETE SUPERSTRUCTURE VESSELS.

DEPTH D		UNSUPPORTED SPAN.					
		Metres. ,92	Metres. 1,22	Metres. 1,5	Metres. 1,85	Metres. 2,15	Metres. 2,45
Metres.		mm.	mm.	mm	mm	mm.	mm.
4,9	ANGLES	100×75× 8,5	115×75× 8,5	130×75× 8,5	140×75× 8,5	130×75× 8	140×75× 9
5,5	ANGLES	100×75× 8,5	115×75× 9	130×75× 9,5	150×75× 8,5	140×75× 8	150×75× 9
6,1	ANGLES	100×75× 9	130×75× 8,5	140×75× 9,5	170×75× 8,5	140×75× 9	150×75×10,5
6,7	ANGLES	115×90× 8,5	140×90× 8,5	150×90× 9	170×90× 9,5	150×85× 9	170×85× 9,5
7,3	ANGLES	115×90× 9,5	140×90× 9	150×90×10	140×85× 8,5	150×85×10,5	180×85× 9
7,9	ANGLES	130×90× 9,5	150×90× 9,5	130×85× 9	140×85× 9,5	170×85× 9,5	180×85×11
8,55	ANGLES	130×90× 9,5	150×90×11	140×85× 8,5	150×85× 9	180×85× 9,5	190×85×10,5
9,15	ANGLES	150×90× 9,5	130×85× 9,5	140×85×10	150×85×10,5	180×85×11	200×85×10,5
9,75	BULB ANGLES	130×85× 9	140×85× 9	150×85× 9,5	170×85× 9,5	190×85×11	200×85×12,5
10,35	BULB ANGLES	130×85× 9,5	150×85× 9	170×85× 8,5	170×85×11	190×85×12,5	220×85×11,5
10,95	BULB ANGLES	130×85×10	150×85× 9,5	170×85×10	180×85×10	200×85×11,5	220×85×13,5
11,6	BULB ANGLES	130×85×11	150×85×10,5	180×85× 9	180×85×11,5	200×85×13	230×90×12,5
12,2	BULB ANGLES	140×85×10,5	170×85× 9	180×85×10	190×85×11	220×85×11,5	240×90×11,5
12,8	BULB ANGLES	140×85×11	170×85×10	180×85×11,5	190×85×12	220×85×13	250×90×11,5
13,4	BULB ANGLES	140×85×12	170×85×11,5	190×85×11	200×85×11,5	230×90×13	250×90×14
14,0	BULB ANGLES	150×85×12	180×85×11	190×85×12,5	200×90×13	240×90×12,5	270×90×13

The Frames are to have the scantlings given in the Tables. The Reversed Frames may be 10 mm. less in depth than given in the Tables, and the horizontal flanges may be 75 mm. in breadth.

In the boiler room the thicknesses of bars not covered by cement are to be increased by 2,5 mm. beyond those given in the Tables.

LLOYD'S REGISTER OF SHIPPING, LONDON.—*25th April*, 1935.

TABLE 7A

DETAILS of BRACKET FLOORS in DOUBLE BOTTOMS.

DEPTH OF FRAME.		RIVETS IN BRACKETS.		RIVETS IN EACH END OF VERTICAL BAR ON INTERCOSTAL GIRDER.		VERTICAL STRUTS BETWEEN INTERCOSTAL GIRDER AND CENTRE LINE OR MARGIN PLATE.	RIVETS IN EACH END OF VERTICAL STRUTS.	
		Number.	Diameter.	Number.	Diameter.	Channels.	Number.	Diameter.
mm. 100 and 110	ANGLES	4	mm. 16	2	mm. 16	mm. $150\times 75\times 75\times \frac{9}{12}$	2	mm. 16
130 „ 140	ANGLES	5	16	2	16	$180\times 75\times 75\times \frac{9}{13}$	3	16
150 „ 170	ANGLES	5	19	2	19	$200\times 85\times 85\times \frac{9,5}{14}$	4	19
130 „ 140	BULB ANGLES	5	19	2	19	$200\times 75\times 75\times \frac{9,5}{14}$	4	19
150 „ 170	BULB ANGLES	6	19	2	19	$200\times 90\times 90\times \frac{10,5}{14}$	4	19
180 „ 190	BULB ANGLES	7	19	3	19	$220\times 90\times 90\times \frac{11,5}{15}$	4	19
200 „ 220	BULB ANGLES	8	19	4	19	$220\times 90\times 90\times \frac{12,5}{15}$	5	19
230 „ 240	BULB ANGLES	8	22	4	22	$260\times 95\times 95\times \frac{13,5}{16}$	6	22
250 and above	BULB ANGLES	9	22	4	22	$260\times 95\times 95\times \frac{13,5}{16}$	6	22

LLOYD'S REGISTER OF SHIPPING, LONDON.—25*th April*, 1935.

TABLE 7B

STIFFENING of WATERTIGHT FLOORS in DOUBLE BOTTOMS.

DEPTH OF CENTRE GIRDER.		HEIGHT OF OVERFLOW ABOVE INNER BOTTOM.						
		Metres. 6,1	Metres. 7,6	Metres. 9,15	Metres. 10,65	Metres. 12,2	Metres. 13,7	Metres. 15,25
mm. 910	ANGLES	mm. 90×75×8	mm. 90×75×10	mm. 100×75×9	mm. 120×75×8,5	mm. 120×75×9,5	mm. 140×75×9	mm. 160×75×10
1060	ANGLES	100×75×8,5	100×75×10,5	120×75×10	130×75×9,5	140×75×9	140×75×10	150×75×9,5
1210	ANGLES	120×75×9,5	130×75×9,5	140×75×9	150×75×9	150×75×10	140×75×8,5	140×75×9
1365	ANGLES	130×75×10	140×75×10	150×75×10	140×75×8,5	140×75×9,5	150×75×8,5	150×75×10
1520	ANGLES	140×75×10	150×75×10,5	140×75×8,5	150×75×8,5	150×75×10	170×75×9,5	170×75×11
1670	ANGLES	150×75×10,5	140×75×8,5	150×75×8,5	170×75×8,5	170×75×11	180×75×10	190×75×9
1820	BULB ANGLES	140×75×8,5	150×75×8,5	170×75×9	180×75×9	180×75×11	190×75×10	200×75×9,5

LLOYD'S REGISTER OF SHIPPING, LONDON.—16*th April*, 1931.

DEPTHS of MARGIN PLATES of DOUBLE BOTTOMS and ATTACHMENT of TANK SIDE BRACKETS to MARGIN PLATES.

TABLE 8

(SEE CONTINUATION.)

DEPTH D		Height of Tank Side Brackets Above Base Line.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF MARGIN PLATE TO LOWEST DECK AT SIDE.													
			Metres. 3,05							Metres. 4,25						
					Attachment outside Margin Plate.							Attachment outside Margin Plate.				
						Gussets to Brackets.		Number and Diameter of Rivets in each Arm.					Gussets to Brackets.		Number and Diameter of Rivets in each Arm.	
Full Scantling Vessels.	Complete Superstructure Vessels.		Thickness of Tank Side Brackets, outside Tank.	Depth of Margin Plate.	Angle Attachment.	Abaft ¼-Length from Stem.	Forward of ¼-Length from Stem.	Angle.	Gusset.	Thickness of Tank Side Brackets, outside Tank.	Depth of Margin Plate.	Angle-Attachment.	Abaft ¼-Length from Stem.	Forward of ¼-Length from Stem.	Angle.	Gusset.
Metres.	Metres.	mm.	mm.	mm.				No. mm.	No. mm.	mm.	mm.				No. mm.	No. mm.
3,65	—	810	7	490	Single	—	—	5 of 16	—	—	—	—	—	—	—	—
4,25	—	910	7,5	510	„	—	—	5 „ 16	—	—	—	—	—	—	—	—
4,9	5,8	1015	8	535	„	—	—	5 „ 19	—	—	—	—	—	—	—	—
5,5	6,4	1115	8	560	„	—	—	5 „ 19	—	8,5	585	Single	—	—	5 of 19	—
6,1	7,0	1220	8,5	585	„	—	—	5 „ 19	—	8,5	610	„	—	—	5 „ 19	—
6,7	7,6	1320	8,5	610	„	—	—	5 „ 19	—	9	635	„	Every fifth frame	Every third frame	6 „ 19	4 of 19
7,3	8,25	1395	8,5	635	„	Every fifth frame	Every third frame	6 „ 19	5 of 19	9	660	„	Every fourth frame	Every second frame	6 „ 19	5 „ 19
7,9	8,85	1475	9	685	„	„	„	6 „ 19	6 „ 19	9,5	710	„	„	„	6 „ 19	6 „ 19
8,55	9,45	1550	9	735	„	Every fourth frame	„	6 „ 22	6 „ 22	9,5	760	„	Every third frame	Every frame	6 „ 22	6 „ 22
9,15	10,05	1625	9,5	785	„	Every third frame	Every second frame	7 „ 22	7 „ 22	9,5	815	„	Every second frame	„	7 „ 22	6 „ 22
9,75	10,65	1700	10	840	„	„	„	7 „ 22	8 „ 22	10	865	„	„	„	7 „ 22	7 „ 22
10,35	11,3	1775	10,5	890	„	Every second frame	„	8 „ 22	8 „ 22	10,5	915	„	Every frame	„	8 „ 22	7 „ 22
10,95	12,2	1855	11	940	„	„	Every frame	8 „ 22	8 „ 22	11	965	„	„	„	8 „ 22	8 „ 22
11,6	12,8	1930	11	990	„	Every frame	„	8 „ 22	8 „ 22	11,5	1015	Double	„	„	7 „ 22	5 „ 22
12,2	13,4	2005	11,5	1040	Double	„	„	7 „ 22	5 „ 22	12	1065	„	„	„	8 „ 22	5 „ 22
12,8	14,0	2080	11,5	1090	„	„	„	8 „ 22	5 „ 22	12	1115	„	„	„	8 „ 22	6 „ 22
13,4	14,65	2160	12	1145	„	„	„	8 „ 22	6 „ 22	—	—	—	—	—	—	—
14,0	15,25	2235	12	1195	„	„	„	8 „ 22	7 „ 22	—	—	—	—	—	—	—

DEPTHS of MARGIN PLATES of DOUBLE BOTTOMS and ATTACHMENT of TANK SIDE BRACKETS to MARGIN PLATES.

TABLE 8

(SEE CONTINUATION.)

DEPTH D		DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF MARGIN PLATE TO LOWEST DECK AT SIDE.														
		Metres. 5,5							Metres. 6,7							
				Attachment outside Margin Plate.							Attachment outside Margin Plate.					
Full Scantling Vessels.	Complete Superstructure Vessels.	Thickness of Tank Side Brackets, outside Tank.	Depth of Margin Plate.	Angle Attachment.	Gussets to Brackets.		Number and Diameter of Rivets in each Arm.		Thickness of Tank Side Brackets, outside Tank.	Depth of Margin Plate.	Angle Attachment.	Gussets to Brackets.		Number and Diameter of Rivets in each Arm.		
					Abaft ¼-Length from Stem.	Forward of ¼-Length from Stem.	Angle.	Gusset.				Abaft ¼-Length from Stem.	Forward of ¼-Length from Stem.	Angle.	Gusset.	
Metres.	Metres.	mm.	mm.				No. mm.	No. mm.	mm.	mm.				No. mm.	No. mm.	
4,9	5,8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
5,5	6,4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
6,1	7,0	9	635	Single	Every fourth frame	Every third frame	5 of 19	4 of 19	9	660	Single	Every fourth frame	Every second frame	6 of 19	6 of 19	
6,7	7,6	9	660	,,	Every third frame	Every second frame	6 ,, 19	5 ,, 19	9,5	685	,,	Every third frame	,,	7 ,, 19	6 ,, 19	
7,3	8,25	9	685	,,	,,	,,	6 ,, 19	6 ,, 19	9,5	735	,,	Every second frame	Every frame	7 ,, 22	6 ,, 22	
7,9	8,85	9,5	735	,,	Every second frame	Every frame	6 ,, 22	6 ,, 22	10	785	,,	,,	,,	7 ,, 22	7 ,, 22	
8,55	9,45	9,5	785	,,	,,	,,	7 ,, 22	6 ,, 22	10	840	,,	Every frame	,,	8 ,, 22	6 ,, 22	
9,15	10,05	10	840	,,	Every frame	,,	8 ,, 22	6 ,, 22	10	890	,,	,,	,,	8 ,, 22	7 ,, 22	
9,75	10,65	10,5	890	,,	,,	,,	8 ,, 22	7 ,, 22	10,5	940	,,	,,	,,	8 ,, 22	8 ,, 22	
10,35	11,3	11	940	,,	,,	,,	8 ,, 22	8 ,, 22	11	990	Double	,,	,,	7 ,, 22	5 ,, 22	
10,95	12,2	11,5	990	Double	,,	,,	7 ,, 22	5 ,, 22	11,5	1040	,,	,,	,,	8 ,, 22	5 ,, 22	
11,6	12,8	12	1040	,,	,,	,,	8 ,, 22	5 ,, 22	12	1090	,,	,,	,,	8 ,, 22	6 ,, 22	
12,2	13,4	12	1090	,,	,,	,,	8 ,, 22	6 ,, 22	—	—	—	—	—	—	—	
12,8	14,0															
13,4	14,65															
14,0	15,25															

DEPTHS of MARGIN PLATES of DOUBLE BOTTOMS and ATTACHMENT of TANK SIDE BRACKETS to MARGIN PLATES.

TABLE 8 (CONCLUDED.)

DEPTH D		DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF MARGIN PLATE TO LOWEST DECK AT SIDE.						
		Metres. 7,9						
		Thickness of Tank Side Brackets, outside Tank.	Depth of Margin Plate.	Attachment outside Margin Plate.				
				Angle Attachment.	Gussets to Brackets.		Number and Diameter of Rivets in each Arm.	
					Abaft ¼-Length from Stem.	Forward of ¼-Length from Stem.	Angle.	Gusset.
Full Scantling Vessels.	Complete Superstructure Vessels.	mm.	mm.				No. mm.	No. mm.
Metres.	Metres.							
4,9	5,8	—	—	—	—	—	—	—
5,5	6,4	—	—	—	—	—	—	—
6,1	7,0	—	—	—	—	—	—	—
6,7	7,6	—	—	—	—	—	—	—
7,3	8,25	—	—	—	—	—	—	—
7,9	8,85	10	840	Single	Every frame	Every frame	8 of 22	7 of 22
8,55	9,45	10	890	Double	„	„	6 „ 22	5 „ 22
9,15	10,05	10,5	940	„	„	„	7 „ 22	5 „ 22
9,75	10,65	11	990	„	„	„	8 „ 22	6 „ 22
10,35	11,3	11,5	1040	„	„	„	8 „ 22	6 „ 22
10,95	12,2	12	—	—	—	—	—	—
11,6	12,8	12,5	—	—	—	—	—	—
12,2	13,4	—	—	—	—	—	—	—
12,8	14,0							
13,4	14,65							
14,0	15,25							

FLOOR PLATES in VESSELS having SINGLE BOTTOMS.

FULL SCANTLING VESSELS. TABLE 9

DEPTH D	BREADTH B								
	Metres. 4,90	Metres. 6,10	Metres. 7,30	Metres. 8,55	Metres. 9,75	Metres. 11,00	Metres. 12,20	Metres. 13,40	Metres. 14,65
Metres. 3,05	mm. 255 × 6	mm. 280 × 6,5	mm. 305 × 7	mm.	mm.	mm.	mm.	mm.	mm.
3,65		305 × 6,5	330 × 7	355 × 7,5					
4,25			355 × 7	380 × 7,5	430 × 8				
4,9				430 × 8	485 × 8,5	535 × 9			
5,50					510 × 8,5	560 × 9,5	610 × 10		
6,10					535 × 9	585 × 9,5	635 × 10	660 × 10,5	
6,70						610 × 10	660 × 10,5	685 × 11	735 × 11,5
7,30						635 × 10	685 × 10,5	710 × 11	760 × 11,5

COMPLETE SUPERSTRUCTURE VESSELS.

DEPTH D	BREADTH B						
	Metres. 7,30	Metres. 8,55	Metres. 9,75	Metres. 11,00	Metres. 12,20	Metres. 13,40	Metres. 14,65
Metres. 4,9	mm. 330 × 7	mm. 355 × 7	mm. 405 × 8	mm. 455 × 8,5	mm.	mm.	mm.
5,50	355 × 7	380 × 7,5	430 × 8	485 × 8,5	510 × 8,5		
6,10			455 × 8,5	510 × 8,5	535 × 9	560 × 9,5	
6,70				535 × 9	560 × 9,5	610 × 10	660 × 10,5
7,30				560 × 9,5	610 × 10	635 × 10	685 × 10,5

In all vessels the thickness of the floors in the engine space is to be increased 1 millimetre and in the boiler space 2,5 millimetres beyond that given in the Tables.

LLOYD'S REGISTER OF SHIPPING, LONDON.—13*th July*, 1922.

KEELSONS in VESSELS with SINGLE BOTTOMS. TABLE 10

FIRST LONGITUDINAL NUMERAL. L×D	MIDDLE LINE KEELSONS.								FLAT KEEL PLATE.		SIDE KEELSONS.		
	With Bar Keel only.		With Bar Keel or Flat Plate Keel.										
	Standing upon Floors.		Standing upon Floors with Intercostal Plates.			Standing upon Floors with Centre Through Plate.							
	Double Bulb Angles.		Double Angles.		Thickness of Intercostal Plates.	Double Angles.	Thickness of Centre Through Plate and Foundation Plate.		Double Angles.		Double Angles.		Thickness of Intercostal Plates.
	For ½-Length Amids.	Thickness at Ends.	For ½-Length Amids.	Thickness at Ends.		Throughout.	For ½-Length Amids.	Thickness at Ends.	For ½-Length Amids.	Thickness at Ends.	For ½-Length Amids.	Thickness at Ends.	
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
55	130×65×10	10	75×75× 8,5	6,5	7	75×75× 6,5	7,5	6,5	75× 75× 6,5	6,5	75×75× 6,5	6	6
100	140×65×10,5	10,5	90×75× 9	7	7,5	90×75× 7	8	7	90× 90× 7,5	7,5	90×75× 7	6,5	6,5
155	150×70×11	11	100×75×10	7	8	90×75× 7,5	8,5	7,5	90× 90× 9	9	100×75× 7,5	7	7
210	170×75×11,5	11	120×75×10	7,5	8,5	100×75× 8	9,5	8,5	90× 90×10	10	120×75× 8	7	7,5
270	180×75×12,5	11,5	120×90×10	8	9	100×90× 8	10	9	90× 90×11	11	120×75× 8,5	7,5	8
340	190×85×13,5	12,5	130×90×11	8,5	9,5	120×90× 8	10,5	9	90× 90×12	11,5	130×75× 9	8	8,5
415	200×85×14,5	13	140×90×11,5	9	10	120×90× 8,5	11	9,5	100×100×13	11,5	140×90× 9,5	8,5	9
505	220×85×15	13	150×90×12	9,5	10,5	120×90× 9	11,5	10	100×100×13,5	12	140×90×10	8,5	9,5
605	230×90×16	13,5	170×90×12,5	10	11	130×90×10	12	10	100×100×14	12,5	150×90×11	9	10
715	240×90×16,5	14	180×90×12,5	10	11,5	150×90×11	12	10	100×100×14,5	12,5	150×90×12	9,5	10

CENTRE and SIDE KEELSONS in TUGS. TABLE 11

FIRST LONGITUDINAL NUMERAL. L×D	CENTRE KEELSON ON TOP OF FLOORS.		SIDE KEELSON ON TOP OF FLOORS.	FIRST LONGITUDINAL NUMERAL. L×D	CENTRE KEELSON ON TOP OF FLOORS.		SIDE KEELSON ON TOP OF FLOORS.
	Single Channel.	Double Bulb Angles.	Single Angle.		Single Channel.	Double Bulb Angles.	Single Angle.
	mm.	mm.	mm.		mm.	mm.	mm.
80	$200\times85\times85\times\frac{10}{14}$	150×70×10	130× 75×9,5	160	$280\times100\times100\times\frac{12}{16,5}$	200×85×11	130×100×10
95	$220\times90\times90\times\frac{10,5}{15}$	150×70×10,5	130×100×9,5	185	$280\times100\times100\times\frac{12,5}{16,5}$	200×85×11,5	130×100×10,5
115	$240\times95\times95\times\frac{11}{15,5}$	170×85×10	130×100×9,5	215		200×85×12	130×100×11,5
135	$260\times95\times95\times\frac{12}{16}$	180×85×11	130×100×9,5	240		200×85×13	130×100×12,5

In the boiler room the thicknesses of the centre and side keelson plates and bars not covered by cement are to be increased by 2,5 millimetres beyond those given in Tables 10 and 11.

LLOYD'S REGISTER OF SHIPPING, LONDON.—16*th June*, 1927.

BEAMS fitted to EVERY FRAME.

TABLE 12
(SEE CONTINUATION.)

BREADTH OF DECK AMIDSHIPS.	SPACING OF BEAMS.		BEAMS AT UPPER DECKS OF SINGLE DECK VESSELS.				BEAMS AT UPPER DECKS IN FULL SCANTLING VESSELS HAVING MORE THAN ONE DECK, IN COMPLETE SUPERSTRUCTURE VESSELS FORWARD OF $\frac{1}{8}$th LENGTH FROM FORWARD AND AT FORECASTLE DECKS.			
			SIZE OF BEAMS AMIDSHIPS.			Thickness of Beam Knees.	SIZE OF BEAMS AMIDSHIPS.			Thickness of Beam Knees.
			With One Row of Pillars.	With Two Rows of Pillars.	With Three Rows of Pillars.		With One Row of Pillars.	With Two Rows of Pillars.	With Three Rows of Pillars.	
Metres.	mm.		mm.	mm.	mm.	mm.	mm.	mm	mm.	mm.
6,1	535	ANGLES	100×75× 8	90×75× 7	75×75× 6,5	7,5				
6,7	535		100×75× 8,5	90×75× 7,5	75×75× 7	7,5				
7,3	545		120×75× 8	100×75× 8	75×75× 7,5	8	120×75× 7,5	90×75× 7,5	75×75× 7,5	7,5
7,9	560		130×75× 8	120×75× 7,5	90×75× 7,5	8	130×75× 7,5	100×75× 8	90×75× 7,5	7,5
8,55	560		140×75× 8	120×75× 8,5	90×75× 7,5	8	130×75× 8	100×75× 8,5	90×75× 7,5	8
9,15	570		150×75× 9	130×75× 8,5	100×75× 8	8,5	130×75× 8,5	120×75× 8	100×75× 8	8
9,75	570	BULB ANGLES	140×75× 9	130×75× 9	100×75× 8,5	8,5	140×75× 8,5	130×75× 8	100×75× 8,5	8,5
10,35	585		150×75× 9,5	140×75× 9	100×75× 9	9	150×75× 9,5	130×75× 8,5	100×75× 9	8,5
10,95	595		170×75× 9,5	150×75× 9,5	120×75× 8,5	9,5	140×75× 9	140×75× 8,5	120×75× 8,5	8,5
11,6	610		180×75×10,5	140×75× 9,5	130×75× 8,5	10	150×75× 9,5	150×75× 9,5	130×75× 8,5	9
12,2	620		190×75×11	150×75× 9,5	140×75× 8,5	10,5	170×75× 9	170×75× 9	140×75× 8,5	9
12,8	635		200×75×11,5	150×75×10,5	140×75× 9	11	180×75× 9,5	140×75× 9	140×75× 9	9,5
13,4	650		220×85×11,5	170×85×10	150×75× 9,5	11,5	190×75×10	150×75× 9	150×75× 9,5	9,5
14,0	660		230×90×12	180×85×10	140×75× 9	12	200×75×11	150×75×10	140×75× 9	10
14,65	685		240×90×12,5	190×85×10,5	170×85× 8	12,5	220×75×11	170×75× 9,5	150×75× 9,5	10
15,25	710		250×90×13,5	190×85×11,5	170×85× 9	13	230×90×11,5	180×85×10	170×85× 9	10,5
15,85	725		270×90×13,5	200×85×11,5	170×85×10	13	240×90×12	180×85×11,5	170×85×10	11
16,45	735		280×90×13,5	200×85×12	180×85×10,5	13,5	250×90×13	190×85×12	180×85×10,5	11,5
17,1	750			220×85×12	190×85×11	13,5	270×90×12,5	200×85×12	190×85×11	11,5
17,7	760			220×85×13	190×85×12	14	270×90×13,5	200×85×13,5	190×85×12	12
18,3	785			230×90×13	200×85×12	14	280×90×13,5	220×85×13,5	200×85×12	12
18,9	815							230×90×13	200×85×12,5	12
19,5	825							230×90×13,5	220×85×11,5	12,5
20,1	840							240×90×13,5	220×85×12	12,5
20,7	850								230×90×11,5	12,5
21,35	865								230×90×12	13
21,95	875								230×90×12,5	13
22,55	890								240×90×12,5	13
23,15	900								240×90×13,5	13,5
23,75	915								250×90×13,5	13,5
24,4	915								250×90×14	14

BEAMS fitted to EVERY FRAME.

TABLE 12
(SEE CONTINUATION.)

BREADTH OF DECK AMIDSHIPS.	SPACING OF BEAMS.		BEAMS AT UPPER DECKS ABAFT $\frac{1}{8}$th LENGTH FROM FORWARD IN COMPLETE SUPERSTRUCTURE VESSELS, AT LONG BRIDGES AND AT POOP DECKS COVERING MACHINERY OPENINGS.				BEAMS AT SHORT BRIDGES AND AT POOP DECKS NOT COVERING MACHINERY OPENINGS.			
			SIZE OF BEAMS AMIDSHIPS.			Thickness of Beam Knees.	SIZE OF BEAMS AMIDSHIPS.			Thickness of Beam Knees.
			With One Row of Pillars.	With Two Rows of Pillars.	With Three Rows of Pillars.		With One Row of Pillars.	With Two Rows of Pillars.	With Three Rows of Pillars.	
Metres.	mm.		mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
6,1	535	ANGLES								
6,7	535									
7,3	545		100×75× 8	90×75× 7,5	75×75× 7,5	7,5				
7,9	560		120×75× 7,5	100×75× 8	90×75× 7,5	7,5	90×75× 7	75×75× 7	75×75× 6,5	7,5
8,55	560		130×75× 7,5	100×75× 8	90×75× 7,5	8	90×75× 7,5	75×75× 7,5	75×75× 7	7,5
9,15	570		130×75× 8	120×75× 7,5	100×75× 8	8	100×75× 8	90×75× 7,5	75×75× 7,5	7,5
9,75	570		130×75× 8,5	120×75× 8	100×75× 8,5	8,5	120×75× 7,5	100×75× 8	90×75× 7,5	7,5
10,35	585		140×75× 8,5	120×75× 8,5	100×75× 9	8,5	120×75× 8,5	100×75× 8,5	90×75× 7,5	8
10,95	595		150×75× 9,5	130×75× 8,5	120×75× 8,5	8,5	130×75× 8,5	120×75× 8	100×75× 8	8
11,6	610	BULB ANGLES	140×75× 9	140×75× 8,5	130×75× 8,5	9	140×75× 8,5	120×75× 8,5	100×75× 8	8,5
12,2	620		150×75× 9,5	150×75× 9	140×75× 8,5	9	150×75× 9,5	130×75× 8,5	100×75× 8,5	8,5
12,8	635		170×75× 9	170×75× 9	140×75× 9	9,5	140×75× 9	140×75× 8,5	120×75× 8	8,5
13,4	650		180×75× 9,5	140×75× 9,5	150×75× 9,5	9,5	150×75× 9	150×75× 9	130×75× 8	9
14,0	660		190×75×10	150×75× 9,5	140×75× 9	10	150×75×10,5	170×75× 8,5	140×75× 8	9
14,65	685		200×75×10,5	150×75×10,5	150×75× 9,5	10	170×75×10	140×75× 9	150×75× 8,5	9,5
15,25	710		220×85×10,5	170×85×10	170×85× 9	10,5	180×75×10	150×75× 9	150×75× 9,5	9,5
15,85	725		230×90×11	180×85×10	170×85×10	11	190×75×10,5	170×75× 8,5	140×75× 9	10
16,45	735		230×90×12	190×85×11	180×85×10,5	11,5	200×75×11,5	170×75× 9,5	140×75× 9,5	10
17,1	750		240×90×12	200×85×11	190×85×11	11,5	220×75×11,5	180×75× 9,5	150×75× 9	10
17,7	760		240×90×13,5	200×85×12	190×85×12	12		190×75× 9,5	150×75× 9,5	10,5
18,3	785		250×90×14	220×85×11,5	200×85×12	12		200×75×10,5	170×75× 9	10,5
18,9	815			220×85×12	200×85×12,5	12		220×75×10	170×75×10	10,5
19,5	825			230×90×12	220×85×11,5	12,5		220×75×12	180×75×10	11
20,1	840			230×90×13	220×85×12	12,5			180×75×10,5	11
20,7	850				230×90×11,5	12,5			190×75×10	11
21,35	865				230×90×12	13			190×75×10,5	11,5
21,95	875				230×90×12,5	13			200×75×10,5	11,5
22,55	890				240×90×12,5	13			200×75×11,5	12
23,15	900				240×90×13,5	13,5			220×75×11	12
23,75	915				250×90×13,5	13,5			220×75×12,5	12,5
24,4	915				250×90×14	14			220×75×13,5	12,5

TABLE 12

BEAMS fitted to EVERY FRAME. (CONCLUDED.)

BREADTH OF DECK AMIDSHIPS.	SPACING OF BEAMS.		BEAMS AT ALL DECKS ON WHICH CARGO IS CARRIED.			
			SIZE OF BEAMS AMIDSHIPS.			Thickness of Beam Knees.
			With One Row of Pillars.	With Two Rows of Pillars.	With Three Rows of Pillars.	
Metres.	mm.		mm.	mm.	mm.	mm.
6,1	535	ANGLES				
6,7	535					
7,3	545					
7,9	560		140×75× 7,5	120×75× 7,5	90×75× 7,5	7,5
8,55	560		150×75× 8	130×75× 7,5	90×75× 7,5	8
9,15	570		150×75× 9,5	140×75× 7,5	100×75× 8	8
9,75	570	BULB ANGLES	140×75× 9	140×75× 8	100×75× 8,5	8,5
10,35	585		150×75× 9,5	150×75× 8,5	100×75× 9	9
10,95	595		170×75× 9,5	150×75× 9,5	120×75× 8,5	9
11,6	610		180×75×10	140×75× 9	130×75× 8,5	9,5
12,2	620		190×75×10	150×75× 9	140×75× 8,5	9,5
12,8	635		200×75×10,5	150×75×10	140×75× 9	10
13,4	650		220×75×10,5	170×75× 9,5	150×75× 9,5	10,5
14,0	660		220×75×12,5	180×75× 9,5	140×75× 9	11
14,65	685		240×90×11,5	190×75× 9,5	150×75× 9,5	11
15,25	710		250×90×12,5	190×75×10,5	150×75×10,5	11,5
15,85	725		270×90×12,5	200×75×11	170×75×10	11,5
16,45	735		280×90×12,5	200×75×12	180×75×10,5	11,5
17,1	750		290×90×13,5	220×75×11,5	190×75×10,5	12
17,7	760			220×75×12,5	190×75×11,5	12
18,3	785			220×75×14	200×75×12	12
18,9	815			220×75×15	200×75×12,5	12
19,5	825			240×90×13,5	220×75×11,5	12,5
20,1	840			250×90×14	220×75×12	12,5
20,7	850				220×75×13	12,5
21,35	865				220×75×13,5	13
21,95	875				220×75×14	13
22,55	890				240×90×12,5	13
23,15	900				240×90×13,5	13,5
23,75	915				250×90×13,5	13,5
24,4	915				250×90×14	14

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BEAMS fitted to ALTERNATE FRAMES.

TABLE 13
(SEE CONTINUATION.)

BREADTH OF DECK AMIDSHIPS.	SPACING OF BEAMS.		BEAMS AT UPPER DECKS OF SINGLE DECK VESSELS.				BEAMS AT UPPER DECKS IN FULL SCANTLING VESSELS HAVING MORE THAN ONE DECK, IN COMPLETE SUPERSTRUCTURE VESSELS FORWARD OF ¼th LENGTH FROM FORWARD, AND AT FORECASTLE DECKS.			
			SIZE OF BEAMS AMIDSHIPS.			Thickness of Beam Knees.	SIZE OF BEAMS AMIDSHIPS.			Thickness of Beam Knees.
			With One Row of Pillars.	With Two Rows of Pillars.	With Three Rows of Pillars.		With One Row of Pillars.	With Two Rows of Pillars.	With Three Rows of Pillars.	
Metres.	mm.		mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
6,1	1070	ANGLES ^	140×75× 8	130×75× 8	100×75×8	7,5				
6,7	1070		140×75× 9	130×75× 8,5	100×75×8,5	7,5				
7,3	1090		150×75× 9,5	140×75× 8,5	120×75×8	8	150×75× 9,5	130×75× 8	120×75× 8	7,5
7,9	1120	v	170×75× 9	150×75× 9	130×75×8	8	150×75×10,5	140×75× 8	130×75× 8	7,5
8,55	1120	^	150×75× 9	170×75× 8,5	130×75×8,5	8,5	170×75× 9	150×75× 8,5	130×75× 8,5	8
9,15	1140		170×75× 8,5	140×75× 9	140×75×8	9	140×75× 9	150×75× 9,5	140×75× 8	8,5
9,75	1140		190×75× 9	140×75×10	140×75×9	9,5	150×75× 9	170×75× 9	140×75× 9	9
10,35	1170		200×75×11	150×75×10	150×75×9,5	10	170×75×10	140×75× 9	150×75× 9,5	9
10,95	1190		220×75×12	170×75× 9,5	170×75×9	10,5	190×75× 9	150×75× 9	170×75× 9	9,5
11,6	1220	BULB ANGLES					200×75×11	170×75× 8,5	140×75× 9	9,5
12,2	1240						220×75×11,5	180×75× 8,5	150×75× 9	10
12,8	1270						220×75×14,5	190×75× 9	170×75× 9	10,5
13,4	1300						250×90×12,5	200×75×10	180×75× 9	11
14,0	1320						270×90×13	200×75×12	190×75× 9,5	11,5
14,65	1370						280×90×14,5	220×75×12	200×75×10,5	12
15,25	1420						300×95×14,5	230×90×12,5	220×85×10,5	12,5
15,85	1450							240×90×13	230×90×11	13
16,45	1470							250×90×13,5	240×90×11,5	13
17,1	1500							270×90×14	250×90×13	13,5
17,7	1520	v						280×90×14	270×90×13	13,5

BEAMS fitted to ALTERNATE FRAMES.

TABLE 13
(SEE CONTINUATION.)

BREADTH OF DECK AMIDSHIPS.	SPACING OF BEAMS.		BEAMS AT UPPER DECKS ABAFT $\frac{1}{8}$th LENGTH FROM FORWARD IN COMPLETE SUPERSTRUCTURE VESSELS, AT LONG BRIDGES AND AT POOP DECKS COVERING MACHINERY OPENINGS.				BEAMS AT SHORT BRIDGES AND AT POOP DECKS, NOT COVERING MACHINERY OPENINGS.			
			SIZE OF BEAMS AMIDSHIPS.			Thickness of Beam Knees.	SIZE OF BEAMS AMIDSHIPS.			Thickness of Beam Knees.
			With One Row of Pillars.	With Two Rows of Pillars.	With Three Rows of Pillars.		With One Row of Pillars.	With Two Rows of Pillars.	With Three Rows of Pillars.	
Metres.	mm.		mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
6,1	1070	ANGLES								
6,7	1070									
7,3	1090		140×75× 8,5	130×75× 8	120×75× 8	7,5				
7,9	1120		150×75× 9,5	140×75× 8	130×75× 8	7,5	120×75× 8	100×75× 8,5	100×75× 8	7,5
8,55	1120		150×75×10,5	140×75× 8,5	130×75× 8,5	8	130×75× 8	120×75× 8	100×75× 8,5	7,5
9,15	1140		170×75× 9	150×75× 9	140×75× 8	8,5	140×75× 8,5	130×75× 8	120×75× 8	8
9,75	1140	BULB ANGLES	140×75× 9	150×75×10	140×75× 9	9	150×75× 9	140×75× 8	120×75× 8,5	8
10,35	1170		150×75× 9	170×75× 8,5	150×75× 9,5	9	170×75× 8,5	140×75× 9	130×75× 8,5	8,5
10,95	1190		170×75× 9,5	140×75× 9	170×75× 9	9,5	140×75× 9	150×75× 9,5	130×75× 9	8,5
11,6	1220		190×75× 9	150×75× 9	140×75× 9	9,5	150×75× 9	150×75×10,5	140×75× 9	9
12,2	1240		200×75×11	170×75× 8,5	150×75× 9	10	170×75× 9,5	140×75× 9	140×75× 9,5	9,5
12,8	1270		220×75×11,5	180×75× 9	170×75× 9	10,5	190×75× 9	150×75× 9	150×75×10	9,5
13,4	1300		220×75×14,5	190×75×10	180×75× 9	11	200×75×10,5	170×75× 8,5	140×75× 9	10
14,0	1320		250×90×12,5	200×75×11	190×75× 9,5	11,5	220×75×10,5	180×75× 8,5	150×75× 9	10,5
14,65	1370		270×90×13	220×75×11	200×75×10,5	12	220×75×12,5	190×75× 9	150×75×10,5	11
15,25	1420		280×90×14	230×90×11,5	220×85×10,5	12,5	240×90×11,5	200×75×10	170×75×10	11,5
15,85	1450		300×95×14	240×90×11,5	230×90×11	13	250×90×13	220×75×10,5	190×75× 9	12
16,45	1470			250×90×13	240×90×11,5	13	270×90×13,5	220×75×12	190×75×10	12,5
17,1	1500			270×90×13	250×90×13	13,5	280×90×15	220×75×14,5	200×75×10	13
17,7	1520			280×90×13,5	270×90×13	13,5	300×95×13,5	240×90×13	220×75×10	13

TABLE 13

BEAMS fitted to ALTERNATE FRAMES. (CONCLUDED.)

BREADTH OF DECK AMIDSHIPS.	SPACING OF BEAMS.		BEAMS AT ALL DECKS ON WHICH CARGO IS CARRIED.			
			SIZE OF BEAMS AMIDSHIPS.			Thickness of Beam Knees.
			With One Row of Pillars.	With Two Rows of Pillars.	With Three Rows of Pillars.	
Metres.	mm.		mm.	mm.	mm.	mm.
6,1	1070	ANGLES				
6,7	1070					
7,3	1090					
7,9	1120	BULB ANGLES	140 × 75 × 9	150 × 75 × 9,5	130 × 75 × 8	8,5
8,55	1120		150 × 75 × 9,5	170 × 75 × 9	130 × 75 × 8,5	9
9,15	1140		170 × 75 × 9,5	140 × 75 × 9	140 × 75 × 8	9,5
9,75	1140		190 × 75 × 9	150 × 75 × 9,5	140 × 75 × 9	10
10,35	1170		200 × 75 × 11	170 × 75 × 9	150 × 75 × 9,5	10,5
10,95	1190		220 × 75 × 12	180 × 75 × 9	170 × 75 × 9	11
11,6	1220		240 × 90 × 11,5	190 × 75 × 9	140 × 75 × 9	11,5
12,2	1240		250 × 90 × 12,5	200 × 75 × 10	150 × 75 × 9	12
12,8	1270		270 × 90 × 13	200 × 75 × 12	170 × 75 × 9	12,5
13,4	1300		280 × 90 × 14	220 × 75 × 12	180 × 75 × 9	12,5
14,0	1320		300 × 95 × 13,5	220 × 75 × 14,5	190 × 75 × 9,5	13
14,65	1370			240 × 90 × 13	200 × 75 × 10,5	13
15,25	1420			250 × 90 × 13,5	220 × 75 × 10,5	13,5
15,85	1450			270 × 90 × 13	220 × 75 × 12,5	13,5
16,45	1470			270 × 90 × 15	240 × 90 × 11,5	14
17,1	1500			280 × 90 × 15	250 × 90 × 13	14
17,7	1520			300 × 95 × 13,5	270 × 90 × 13,5	14

DIAMETERS of SOLID IRON or STEEL PILLARS FITTED TWO FRAME SPACES APART.

TABLE 14

(SEE CONTINUATION.)

LENGTH OF PILLAR.	ONE ROW OF PILLARS.													TWO ROWS OF PILLARS.											
	To Beams of Upper Deck.							To Beams of Second Deck.						To Beams of Upper Deck.				To Beams of Second Deck.				To Beams of Third Deck.			
	Length of Beam Amidships in Metres.													Length of Beam Amidships in Metres.											
	6,1	7,9	9,75	11,6	13,4	15,25	17,05	7,9	9,75	11,6	13,4	15,25	17,05	15,25	17,05	18,9	20,75	15,25	17,05	18,9	20,75	15,25	17,05	18,9	20,75
Metres.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
2,45	57	60	63	67	70	73	76	76	79	83	86	89	92	67	70	73	76	83	86	89	92	95	98	102	105
3,05	60	63	67	70	73	76	79	83	86	89	92	95	98	70	73	76	79	89	92	95	98	102	105	108	111
3,65	63	67	70	73	76	79	83	89	92	95	98	102	105	73	76	79	83	95	98	102	105	108	111	114	117
4,25	70	73	76	79	83	86	89	92	95	102	108	111	114	79	83	86	89	102	108	111	114	114	121	124	127
4,9	76	79	83	86	89	92	95		102	108	114	121	124	86	89	92	95	108	114	121	124	121	127	133	137
5,5		86	89	92	95	98	102			114	121	127	133	92	95	98	102	114	121	127	133	127	133	140	146
6,1		92	95	98	102	105	108				130	133	140	98	102	105	108	121	127	133	140	133	140	146	152
6,7		98	102	105	108	111	114					140	146	105	108	111	114	127	133	140	146	140	146	152	159
7,3		105	108	111	114	117	121						152	111	114	117	121	133	140	146	152	146	152	159	165
7,9			114	117	121	124	127							117	121	124	127	140	146	152	159		159	165	171
8,55				124	127	130	133							124	127	130	133	146	152	159	165			171	178
9,15					133	137	140							130	133	137	140	152	159	165	171				
9,75						143	146							137	140	143	146	159	165	171	178				

The pillars to beams of detached Superstructure decks may be 3 mm. less in diameter than those required by above Table for beams to Upper decks.

DOUBLE ANGLE GIRDERS at HEADS of CLOSELY SPACED PILLARS.

FRAME SPACING.	SIZE OF ANGLES IN MM.
mm. 585	mm. 75 × 75 × 7,5
685	90 × 90 × 9,5
785	100 × 100 × 12
890	100 × 100 × 14

DIAMETERS of SOLID IRON or STEEL PILLARS FITTED TWO FRAME SPACES APART.

TABLE 14 (CONCLUDED.)

LENGTH OF PILLAR.	TWO ROWS OF PILLARS. To Beams of Fourth Deck. Length of Beam Amidships in Metres.				THREE ROWS OF PILLARS. To Beams of Upper Deck. Length of Beam Amidships in Metres.				To Beams of Second Deck. Length of Beam Amidships in Metres.				To Beams of Third Deck. Length of Beam Amidships in Metres.				To Beams of Fourth Deck. Length of Beam Amidships in Metres.				To Beams of Fifth Deck. Length of Beam Amidships in Metres.			
	15,25	17,05	18,9	20,75	18,9	20,75	22,55	24,4	18,9	20,75	22,55	24,4	18,9	20,75	22,55	24,4	18,9	20,75	22,55	24,4	18,9	20,75	22,55	24,4
Metres.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
2,45	105	108	111	114	67	70	73	76	83	86	89	92	95	98	102	105	105	108	111	114	111	114	117	121
3,05	111	114	117	121	70	73	76	79	89	92	95	98	102	105	108	111	111	114	117	121	117	121	124	127
3,65	117	121	124	130	73	76	79	83	95	98	102	105	108	111	114	117	117	121	124	130	124	127	130	137
4,25	124	130	133	137	79	83	86	89	102	108	111	114	114	121	124	127	124	130	133	137	130	137	140	143
4,9	130	137	143	146					108	114	121	127	121	127	133	137	130	137	143	146	137	143	149	152
5,5	137	143	149	156					114	121	127		127	133	140	146	137	143	149	156	143	149	156	162
6,1	143	149	156	162					121	127			133	140	146	152	143	149	156	162	149	156	162	168
6,7	149	156	162	168					127	133			140	146	152	159	149	156	162	168	156	162	168	175
7,3	156	162	168	175					133	140			146	152	159	165	156	162	168	175	162	168	175	
7,9									140				152	159	165	171								
8,55									146				159	165	171	178								
9,15									152				165	171	178									
9,75													171	178										

The pillars to beams of detached Superstructure decks may be 3 mm. less in diameter than those required by above Table for beams to Upper decks.

EQUIVALENT PILLARS of IRON and STEEL.

	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
Solid Pillars as per Table. Diameter ...	54	57	60	63	67	70	73	76	79	83	86	89	92	95
Equivalent Hollow Pillars. Diameter and Thickness	63 × 8	70 × 8	76 × 8	76 × 9,5	83 × 9,5	89 × 9,5	95 × 9,5	102 × 11	108 × 11	114 × 11	121 × 11	127 × 11	140 × 11	146 × 12,5

	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
Solid Pillars as per Table. Diameter ...	98	102	108	114	121	127	133	140	146	152	159	165	171	
Equivalent Hollow Pillars. Diameter and Thickness.....	152 × 12,5	152 × 14,5	159 × 14,5	165 × 14,5	171 × 14,5	178 × 14,5	178 × 16	190 × 16	197 × 16	216 × 16	216 × 17,5	222 × 17,5	229 × 17,5	

The Hollow Pillars required by the above Table are to have Solid Welded Heads and Heels.

WIDELY SPACED STEEL PILLARS.

TABLE 15
(SEE CONTINUATION.)

VALUES OF S × B × H	LENGTH AND FORM OF PILLAR.							
	Metres. 2,45				Metres. 3,05			
	Tubular	Double Channels and Face Plates.		Four Angles.	Tubular.	Double Channels and Face Plates.		Four Angles.
	Outside Diameter.	Channels.	Plates.		Outside Diameter.	Channels.	Plates.	
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
37	155 × 9	150 × 75 × 75 × 10/12			155 × 9,5	150 × 75 × 75 × 10,5/12		
45	155 × 10	150 × 75 × 75 × 11/12			170 × 10	150 × 85 × 85 × 9,5/14		
54	170 × 10	150 × 85 × 85 × 9,5/14			180 × 10	180 × 80 × 80 × 11,5/13		
62	180 × 10	180 × 80 × 80 × 11,5/13			190 × 10	180 × 80 × 80 × 12,5/13		100 × 100 × 10,5
71	190 × 10	180 × 80 × 80 × 12,5/13			205 × 10	180 × 90 × 90 × 11/16		100 × 100 × 11
82	205 × 10	180 × 90 × 90 × 11/16		100 × 100 × 10,5	205 × 11	180 × 90 × 90 × 12/16		100 × 100 × 11,5
93	230 × 10	200 × 85 × 85 × 12/14		120 × 120 × 9,5	230 × 10,5	200 × 85 × 85 × 12,5/14		120 × 120 × 10
105	255 × 10	200 × 90 × 90 × 11,5/17		130 × 130 × 10	255 × 10,5	200 × 90 × 90 × 12/17		130 × 130 × 10,5
119	255 × 11	200 × 90 × 90 × 13/17		130 × 130 × 11	255 × 11,5	200 × 90 × 90 × 13,5/17		130 × 130 × 11,5
133	280 × 11	220 × 95 × 95 × 13/17		130 × 130 × 12	280 × 12	220 × 95 × 95 × 14,5/17		130 × 130 × 12,5
147	280 × 12,5	220 × 95 × 95 × 14,5/17		130 × 130 × 13	305 × 11,5	220 × 95 × 95 × 15,5/17		130 × 130 × 13,5
164	305 × 12	220 × 95 × 95 × 16/17		130 × 130 × 14,5	305 × 12,5	200 × 85 × 85 × 14,5/14	255 × 10	130 × 130 × 15
181	330 × 12,5	220 × 90 × 90 × 13,5/15	255 × 10,5	150 × 150 × 13	330 × 12,5	220 × 90 × 90 × 13,5/15	280 × 10,5	150 × 150 × 13
201	330 × 13,5	240 × 95 × 95 × 11/15,5	280 × 10,5	150 × 150 × 14	330 × 14	240 × 95 × 95 × 11,5/15,5	280 × 11	150 × 150 × 14
221	355 × 13,5	260 × 95 × 95 × 11,5/16	280 × 11,5	150 × 150 × 15,5	355 × 14	260 × 95 × 95 × 12/16	280 × 11,5	150 × 150 × 15,5
243	380 × 13,5	260 × 95 × 95 × 12/16	305 × 12,5	150 × 150 × 16,5	380 × 14	260 × 95 × 95 × 12,5/16	305 × 12,5	150 × 150 × 16,5
266	405 × 13,5	260 × 95 × 95 × 13/16	305 × 14	150 × 150 × 18	405 × 14	260 × 95 × 95 × 13,5/16	305 × 14	150 × 150 × 18
289	430 × 14	260 × 95 × 95 × 13/16	305 × 15	160 × 160 × 17	430 × 14,5	260 × 95 × 95 × 13,5/16	305 × 15	160 × 160 × 17
311	430 × 15	280 × 100 × 100 × 11/16,5	330 × 15	160 × 160 × 18	430 × 16	280 × 100 × 100 × 11,5/16,5	330 × 15	160 × 160 × 18
334	455 × 15	280 × 100 × 100 × 13/16,5	330 × 18	160 × 160 × 19,5	455 × 16,5	280 × 100 × 100 × 13,5/16,5	330 × 18	160 × 160 × 19,5
357	455 × 17	280 × 100 × 100 × 13/16,5	330 × 19	160 × 160 × 20,5	455 × 17,5	280 × 100 × 100 × 13,5/16,5	330 × 19	160 × 160 × 20,5
380	480 × 17			160 × 160 × 22	480 × 17,5			160 × 160 × 22

WIDELY SPACED STEEL PILLARS.

TABLE 15
(SEE CONTINUATION.)

VALUES OF S×B×H	LENGTH AND FORM OF PILLAR.							
	Metres. 3,65				Metres. 4,25			
	Tubular.	Double Channels and Face Plates.		Four Angles.	Tubular.	Double Channels and Face Plates.		Four Angles.
	Outside Diameter.	Channels.	Plates.		Outside Diameter.	Channels.	Plates.	
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
37	170× 9,5	150× 85× 85× 9/14			180× 9,5	180× 80× 80× 11/13		100×100×10,5
45	180× 9,5	180× 80× 80× 11/13			190× 9,5	180× 80× 80× 12/13		100×100×11
54	190×10	180× 80× 80× 12,5/13			205×10	180× 90× 90× 11/16		100×100×11,5
62	205×10	180× 90× 90× 11/16		100×100×11,5	220×10	200× 85× 85× 12/14		120×120× 9,5
71	220×10	200× 85× 85× 12/14		120×120× 9,5	220×10,5	200× 85× 85× 12,5/14		120×120×10,5
82	220×11	200× 85× 85× 12,5/14		120×120×10,5	230×10,5	200× 85× 85× 13/14		130×130×10
93	230×11	200× 85× 85× 13/14		130×130×10	255×10,5	200× 90× 90× 12,5/17		130×130×11
105	255×11	200× 90× 90× 13/17		130×130×11	255×12	220× 95× 95× 13,5/17		130×130×12,5
119	255×12,5	220× 95× 95× 14/17		130×130×12,5	280×12	200× 85× 85× 14,5/14	230×10	130×130×13,5
133	280×12,5	220× 95× 95× 15,5/17		130×130×13,5	305×12,5	220× 90× 90× 11/15	255×10	130×130×15
147	305×12	200× 85× 85× 14,5/14	255×10	130×130×15	305×13,5	220× 90× 90× 14,5/15	255×10,5	150×150×13
164	305×13	220× 90× 90× 14,5/15	255×10,5	150×150×13	330×13	220× 90× 90× 14,5/15	280×10,5	150×150×14
181	330×13	220× 90× 90× 14,5/15	280×10,5	150×150×14	330×14	240× 95× 95× 12/15,5	280×11	150×150×15,5
201	355×13	260× 95× 95× 12,5/16	280×11,5	150×150×15,5	355×13,5	260× 95× 95× 12,5/16	280×11,5	150×150×16,5
221	355×14,5	260× 95× 95× 12,5/16	305×12	150×150×16,5	380×13,5	260× 95× 95× 13/16	305×12,5	150×150×18
243	380×15	260× 95× 95× 13,5/16	305×12,5	150×150×18	405×14	260× 95× 95× 13,5/16	305×14	160×160×17
266	405×15	260× 95× 95× 13,5/16	305×15	160×160×17	430×14	260× 95× 95× 13,5/16	305×15	160×160×18
289	430×15	280×100×100× 11/16,5	330×15	160×160×18	430×16,5	280×100×100× 11,5/16,5	330×16,5	160×160×19,5
311	455×15	280×100×100× 13/16,5	330×18	160×160×19,5	455×16,5	280×100×100× 13,5/16,5	330×18	160×160×20,5
334	455×17			200×200×16,5	480×15,5			200×200×18
357	480×17			200×200×18	480×18			200×200×19
380	480×18			200×200×19	510×17,5			

WIDELY SPACED STEEL PILLARS.

TABLE 15
(SEE CONTINUATION.)

VALUES OF S×B×H	LENGTH AND FORM OF PILLAR.							
	Metres. 4,9				Metres. 5,5			
	Tubular.	Double Channels and Face Plates.		Four Angles.	Tubular.	Double Channels and Face Plates.		Four Angles.
	Outside Diameter.	Channels.	Plates.		Outside Diameter.	Channels.	Plates.	
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
37	180×10	180× 80× 80× 11,5/13		100×100×11	190×10	180× 80× 80× 12,5/13		120×120×10,5
45	190×10	180× 80× 80× 12,5/13		100×100×11,5	205×10	180× 90× 90× 11/16		120×120×11
54	205×10	180× 90× 90× 11/16		120×120×10,5	220×10	200× 85× 85× 13/14		130×130×10
62	220×10	200× 85× 85× 12,5/14		120×120×11,5	230×10	200× 85× 85× 13,5/14		130×130×10,5
71	230×10	200× 85× 85× 13/14		130×130×10	230×11	200× 85× 85× 14,5/14		130×130×11
82	230×11	200× 85× 85× 14/14		130×130×11	255×10,5	200× 90× 90× 13,5/17		130×130×12,5
93	255×11	200× 90× 90× 13,5/17		130×130×12,5	255×11,5	220× 95× 95× 13,5/17		130×130×13,5
105	255×12,5	220× 95× 95× 14/17		130×130×13,5	280×11,5	220× 95× 95× 14,5/17		130×130×15
119	280×12,5	200× 85× 85× 15,5/14	255×10	130×130×15	305×12	220× 90× 90× 11/15	255×10,5	150×150×13
133	305×13	220× 90× 90× 12/15	255×10,5	150×150×13	305×13,5	220× 90× 90× 14,5/15	255×10,5	150×150×14
147	305×13,5	240× 95× 95× 12/15,5	280×10,5	150×150×14	330×12,5	240× 95× 95× 12/15,5	280×11,5	150×150×15,5
164	330×13,5	260× 95× 95× 11/16	280×11,5	150×150×15,5	330×14	260× 95× 95× 12,5/16	305×11,5	150×150×16,5
181	355×13,5	260× 95× 95× 12,5/16	305×12,5	150×150×16,5	355×14	260× 95× 95× 13/16	305×13	150×150×17,5
201	355×14,5	260× 95× 95× 13/16	305×14	150×150×18	380×14	260× 95× 95× 13/16	305×15	160×160×17
221	380×14,5	260× 95× 95× 13/16	305×15	160×160×17	405×14	260× 95× 95× 13/16	330×14	160×160×18
243	405×15	260× 95× 95× 13,5/16	330×15	160×160×18	430×14	280×100×100× 11/16,5	330×15	160×160×19,5
266	430×15	280×100×100× 11,5/16,5	330×17	160×160×19,5	430×15,5	280×100×100× 13/16,5	330×16,5	160×160×20,5
289	455×15	280×100×100× 13,5/16,5	330×18	160×160×20,5	455×15,5			160×160×22
311	480×15			160×160×22	480×15,5			160×160×23
334	480×17			200×200×19	480×17,5			200×200×20,5
357	510×17			200×200×20,5	510×17,5			
380					535×17,5			

WIDELY SPACED STEEL PILLARS.

TABLE 15
(SEE CONTINUATION.)

VALUES OF S×B×H	LENGTH AND FORM OF PILLAR.							
	Metres. 6,1				Metres. 6,7			
	Tubular.	Double Channels and Face Plates.		Four Angles.	Tubular.	Double Channels and Face Plates.		Four Angles.
	Outside Diameter.	Channels.	Plates.		Outside Diameter.	Channels.	Plates.	
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
37	205×10	180×90×90×11/16		120×120×11	220×10	200×85×85×13,5/14		120×120×11,5
45	220×10	200×85×85×13/14		120×120×11,5	230×10	200×85×85×14,5/14		130×130×10,5
54	230×10	200×85×85×14/14		130×130×10,5	230×11	200×90×90×13,5/17		130×130×11
62	230×11	200×85×85×14,5/14		130×130×11	255×10	200×90×90×14,5/17		130×130×12,5
71	255×10	200×90×90×14/17		130×130×12,5	255×10,5	220×95×95×13,5/17		130×130×13,5
82	255×11	220×95×95×13,5/17		130×130×13,5	255×11,5	220×95×95×14,5/17		130×130×14
93	255×12	220×95×95×14,5/17		130×130×14,5	255×12,5	220×95×95×15,5/17		130×130×15
105	280×12	200×85×85×15,5/14	255×10	150×150×13	280×12,5	200×85×85×15,5/14	255×10,5	150×150×13,5
119	305×12,5	220×90×90×12/15	255×10,5	150×150×14	305×13	220×90×90×12/15	280×10,5	150×150×14,5
133	330×12,5	240×95×95×12/15,5	280×11,5	150×150×15	330×13	260×95×95×11/16	280×11,5	150×150×15,5
147	330×13	240×95×95×12/15,5	305×12,5	150×150×15,5	330×13,5	260×95×95×11/16	305×12,5	150×150×16,5
164	355×13	260×95×95×13/16	305×13	150×150×17,5	355×13,5	260×95×95×13/16	305×14	150×150×18
181	355×14,5	260×95×95×13/16	305×15	150×150×18	380×13	260×95×95×13/16	305×15	160×160×17
201	380×14,5	260×95×95×13/16	330×15	160×160×17,5	380×15	260×95×95×13/16	330×15	160×160×18
221	405×14,5	260×95×95×13/16	330×17,5	160×160×19	405×15	260×95×95×13,5/16	330×18	160×160×19,5
243	430×14,5	280×100×100×11/16,5	330×18,5	160×160×20	430×15	280×100×100×11,5/16,5	330×18,5	160×160×20,5
266	455×14,5	280×100×100×13,5/16,5	330×19	160×160×21,5	455×15	280×100×100×14/16,5	330×19	160×160×22
289	455×16,5	300×100×100×14/17	330×19	160×160×22,5	480×15	300×100×100×15/17	330×19	160×160×23
311	480×16,5	300×100×100×16,5/17	355×19	200×200×20	480×17	300×100×100×17/17	355×19,5	200×200×20,5
334	510×16,5			200×200×21	510×17			200×200×21
357	510×18				535×17			
380	535×18				560×17			

WIDELY SPACED STEEL PILLARS.

TABLE 15
(SEE CONTINUATION.)

VALUES OF S × B × H	LENGTH AND FORM OF PILLAR.							
	Metres. 7,3				Metres. 7,9			
	Tubular.	Double Channels and Face Plates.		Four Angles.	Tubular.	Double Channels and Face Plates.		Four Angles.
	Outside Diameter.	Channels.	Plates.		Outside Diameter.	Channels.	Plates.	
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
37	230 × 10	200 × 90 × 90 × 13,5/17		130 × 130 × 11	230 × 11	200 × 90 × 90 × 14/17		130 × 130 × 12,5
45	230 × 11	200 × 90 × 90 × 14/17		130 × 130 × 11	255 × 10	220 × 95 × 95 × 13,5/17		130 × 130 × 12,5
54	255 × 10	220 × 95 × 95 × 13/17		130 × 130 × 12,5	255 × 11	220 × 95 × 95 × 14,5/17		130 × 130 × 13,5
62	255 × 10,5	220 × 95 × 95 × 13,5/17		130 × 130 × 13	255 × 11,5	220 × 95 × 95 × 15/17		130 × 130 × 13,5
71	255 × 11	220 × 95 × 95 × 14,5/17		130 × 130 × 13,5	255 × 12	220 × 95 × 95 × 15,5/17		130 × 130 × 15
82	255 × 12	220 × 95 × 95 × 15,5/17		130 × 130 × 15	255 × 12,5	200 × 85 × 85 × 15,5/14	255 × 10,5	150 × 150 × 13
93	280 × 12	200 × 85 × 85 × 15,5/14	255 × 10,5	150 × 150 × 13	280 × 12,5	220 × 90 × 90 × 12/15	280 × 10,5	150 × 150 × 14
105	305 × 12	220 × 90 × 90 × 12/15	280 × 10,5	150 × 150 × 14	305 × 12,5	220 × 90 × 90 × 14,5/15	280 × 11,5	150 × 150 × 15
119	305 × 13,5	240 × 95 × 95 × 12/15,5	280 × 11	150 × 150 × 15,5	330 × 12,5	260 × 95 × 95 × 12,5/16	280 × 12,5	150 × 150 × 16
133	330 × 13,5	260 × 95 × 95 × 12,5/16	305 × 12,5	150 × 150 × 16,5	330 × 14	260 × 95 × 95 × 13/16	305 × 13	150 × 150 × 17
147	330 × 14,5	260 × 95 × 95 × 13/16	305 × 14	150 × 150 × 17,5	355 × 13	260 × 95 × 95 × 13/16	305 × 14	150 × 150 × 18
164	355 × 14,5	260 × 95 × 95 × 13/16	305 × 15	150 × 150 × 18	380 × 13	260 × 95 × 95 × 13/16	305 × 15	160 × 160 × 17
181	380 × 14	260 × 95 × 95 × 13/16	330 × 15	160 × 160 × 17,5	380 × 15	280 × 100 × 100 × 11/16,5	330 × 15	160 × 160 × 18
201	405 × 14	260 × 95 × 95 × 13,5/16	330 × 18	160 × 160 × 19	405 × 15	280 × 100 × 100 × 11/16,5	330 × 18	160 × 160 × 19,5
221	430 × 14	280 × 100 × 100 × 11,5/16,5	330 × 19	160 × 160 × 20	430 × 15	280 × 100 × 100 × 13/16,5	330 × 19	160 × 160 × 20,5
243	430 × 16,5	280 × 100 × 100 × 14/16,5	330 × 19	160 × 160 × 21,5	455 × 15	300 × 100 × 100 × 15/17	330 × 19	160 × 160 × 22
266	455 × 16,5	300 × 100 × 100 × 14/17	330 × 19	160 × 160 × 22,5	455 × 17	300 × 100 × 100 × 16,5/17	330 × 19	160 × 160 × 23
289	480 × 16,5	300 × 100 × 100 × 17/17	355 × 19,5	160 × 160 × 23	480 × 17	300 × 100 × 100 × 18/17	355 × 19,5	200 × 200 × 20,5
311	480 × 17,5			200 × 200 × 20,5	510 × 17			
334	510 × 17,5			200 × 200 × 21,5	535 × 17			
357	535 × 17,5				560 × 17			
380	560 × 17,5				560 × 18			

WIDELY SPACED STEEL PILLARS.

TABLE 15
(CONCLUDED.)

VALUES OF S×B×H	LENGTH AND FORM OF PILLAR.							
	Metres. 8,55				Metres. 9,15			
	Tubular.	Double Channels and Face Plates.		Four Angles.	Tubular.	Double Channels and Face Plates.		Four Angles.
	Outside Diameter.	Channels.	Plates.		Outside Diameter.	Channels.	Plates.	
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
37	255 × 10,5	220 × 95 × 95 × 13,5/17		130 × 130 × 13,5	255 × 12	220 × 95 × 95 × 15,5/17		150 × 150 × 13
45	255 × 11	220 × 95 × 95 × 14,5/17		130 × 130 × 13,5	255 × 12,5	200 × 85 × 85 × 15,5/14	255 × 10,5	150 × 150 × 13
54	255 × 12	220 × 95 × 95 × 15,5/17		130 × 130 × 15	280 × 11	220 × 90 × 90 × 11,5/15	280 × 10,5	150 × 150 × 14
62	255 × 12	200 × 85 × 85 × 15,5/14	255 × 10	150 × 150 × 13	280 × 11	220 × 90 × 90 × 11,5/15	280 × 11	150 × 150 × 14
71	280 × 11	220 × 90 × 90 × 11,5/15	280 × 10,5	150 × 150 × 13,5	280 × 12	220 × 90 × 90 × 12/15	280 × 11,5	150 × 150 × 15
82	280 × 12	220 × 90 × 90 × 12/15	280 × 11	150 × 150 × 14	280 × 12,5	220 × 90 × 90 × 12/15	280 × 11,5	150 × 150 × 15,5
93	305 × 12	220 × 90 × 90 × 14,5/15	280 × 11,5	150 × 150 × 15	305 × 12,5	220 × 90 × 90 × 14,5/15	305 × 12,5	150 × 150 × 16
105	305 × 13	240 × 95 × 95 × 12,5/15,5	280 × 11,5	150 × 150 × 15,5	305 × 13,5	240 × 95 × 95 × 12/15,5	305 × 12,5	150 × 150 × 16,5
119	330 × 13	260 × 95 × 95 × 12,5/16	305 × 12,5	150 × 150 × 16,5	330 × 13,5	260 × 95 × 95 × 12,5/16	305 × 14	150 × 150 × 17,5
133	355 × 13	260 × 95 × 95 × 13/16	305 × 14	150 × 150 × 18	355 × 13,5	260 × 95 × 95 × 13/16	305 × 15	160 × 160 × 17
147	355 × 14	260 × 95 × 95 × 13/16	305 × 15,5	160 × 160 × 17	355 × 15	280 × 100 × 100 × 11/16,5	330 × 15	160 × 160 × 18
164	380 × 14	260 × 95 × 95 × 13/16	330 × 16,5	160 × 160 × 18	380 × 15	280 × 100 × 100 × 13/16,5	330 × 17	160 × 160 × 19,5
181	405 × 14	260 × 95 × 95 × 13,5/16	330 × 18	160 × 160 × 19,5	405 × 15	280 × 100 × 100 × 13/16,5	330 × 18	160 × 160 × 20,5
201	405 × 15,5	280 × 100 × 100 × 11/16,5	330 × 19	160 × 160 × 20,5	430 × 15	280 × 100 × 100 × 14/16,5	330 × 19	160 × 160 × 21,5
221	430 × 15,5	280 × 100 × 100 × 14/16,5	330 × 19	160 × 160 × 21,5	455 × 15	300 × 100 × 100 × 15/17	330 × 19	200 × 200 × 19
243	455 × 15,5				455 × 17			
266	480 × 15,5				480 × 17			
289	480 × 17,5				510 × 17			
311	510 × 17,5				510 × 18			
334	535 × 17,5				535 × 18			
357	560 × 17,5				560 × 18			
380								

TABLE 15A

WIDELY SPACED SOLID PILLARS in 'TWEEN DECKS.

VALUES OF S × B × H	LENGTH OF PILLAR.			
	2,45 metres.		3,05 metres.	
	Diameter.	Number of 22 mm. rivets in heads and heels.	Diameter.	Number of 22 mm. rivets in heads and heels.
	mm.		mm.	
20	76	4	83	4
25	83	4	89	4
30	89	4	95	4
37	95	4	102	4
45	102	4	108	5
54	108	5	114	5
62	114	5	121	5
71	121	5	127	6
82	127	6	133	6
93	133	6	140	7
105	140	7	146	7
119	146	7	152	8
133	152	8	159	8
147	159	8	165	8
164	165	8		

LLOYD'S REGISTER OF SHIPPING, LONDON.—*25th June*, 1925.

DECK GIRDERS at HEADS of WIDELY SPACED PILLARS, CHANNELS or ANGLES.

TABLE 16

(SEE CONTINUATION.)

VALUES OF $S^2 \times B \times H$	Thickness of Intercostal Plate and Angle.	DEPTH OF BEAMS.					
		mm. 125		mm. 150		mm. 180	
		SIZE AND TYPE OF GIRDER.					
		Double Channels.	Double Angles.	Double Channels.	Double Angles.	Double Channels.	Double Angles.
165	mm. 8,5	mm.	mm. $150 \times 100 \times 11,5$	mm.	mm. $150 \times 100 \times 10,5$	mm.	mm. $150 \times 100 \times 9,5$
190	8,5		$150 \times 100 \times 13$		$150 \times 100 \times 11,5$		$150 \times 100 \times 10,5$
225	8,5	$165 \times 80 \times 80 \times \frac{11,5}{12}$	$150 \times 100 \times 14$		$150 \times 100 \times 13$		$150 \times 100 \times 11,5$
260	10	$180 \times 80 \times 80 \times \frac{11,5}{13}$	$150 \times 100 \times 16,5$	$165 \times 80 \times 80 \times \frac{11,5}{12}$	$150 \times 100 \times 14$		$150 \times 100 \times 13$
300	10	$180 \times 90 \times 90 \times \frac{10,5}{16}$	$170 \times 115 \times 15$	$180 \times 80 \times 80 \times \frac{11,5}{13}$	$150 \times 100 \times 16,5$	$165 \times 80 \times 80 \times \frac{11,5}{12}$	$150 \times 100 \times 14$
345	10	$200 \times 85 \times 85 \times \frac{12}{14}$	$170 \times 115 \times 16$	$180 \times 90 \times 90 \times \frac{10,5}{16}$	$170 \times 115 \times 15$	$180 \times 80 \times 80 \times \frac{11,5}{13}$	$150 \times 100 \times 16,5$
395	10	$220 \times 90 \times 90 \times \frac{11,5}{15}$	$150 \times 150 \times 16,5$	$200 \times 85 \times 85 \times \frac{12}{14}$	$170 \times 115 \times 16$	$180 \times 90 \times 90 \times \frac{10,5}{16}$	$170 \times 115 \times 15$
450	11	$220 \times 90 \times 90 \times \frac{15}{15}$	$150 \times 150 \times 19$	$220 \times 90 \times 90 \times \frac{11,5}{15}$	$150 \times 150 \times 16,5$	$200 \times 85 \times 85 \times \frac{12}{14}$	$170 \times 115 \times 16$
500	11	$240 \times 95 \times 95 \times \frac{15}{15,5}$	$160 \times 160 \times 19,5$	$220 \times 90 \times 90 \times \frac{15}{15}$	$150 \times 150 \times 19$	$220 \times 90 \times 90 \times \frac{11,5}{15}$	$150 \times 150 \times 16,5$
560	11	$260 \times 95 \times 95 \times \frac{15,5}{16}$	$160 \times 160 \times 22$	$240 \times 95 \times 95 \times \frac{15}{15,5}$	$160 \times 160 \times 19,5$	$220 \times 90 \times 90 \times \frac{15}{15}$	$150 \times 150 \times 19$
630	11			$260 \times 95 \times 95 \times \frac{15,5}{16}$	$160 \times 160 \times 22$	$240 \times 95 \times 95 \times \frac{15}{15,5}$	$160 \times 160 \times 19,5$
700	11			$300 \times 100 \times 100 \times \frac{12}{17}$		$260 \times 95 \times 95 \times \frac{15,5}{16}$	$160 \times 160 \times 22$
775	12,5			$300 \times 100 \times 100 \times \frac{16}{17}$		$300 \times 100 \times 100 \times \frac{12}{17}$	
855	12,5			$300 \times 100 \times 100 \times \frac{12}{17}$ Rider Plate 205×15		$300 \times 100 \times 100 \times \frac{16}{17}$	
940	12,5			$300 \times 100 \times 100 \times \frac{14,5}{17}$ Rider Plate 205×18		$300 \times 100 \times 100 \times \frac{12}{17}$ Rider Plate 205×15	
1035	12,5			$320 \times 100 \times 100 \times \frac{14}{17,5}$ Rider Plate 230×18		$300 \times 100 \times 100 \times \frac{14,5}{17}$ Rider Plate 205×18	
1140	12,5			$320 \times 100 \times 100 \times \frac{14,5}{17,5}$ Rider Plate 255×19			
1250	12,5						
1370	12,5						
1510	13,5						
1655	13,5						
1810	13,5						
1975	13,5						

DECK GIRDERS at HEADS of WIDELY SPACED PILLARS, CHANNELS or ANGLES.

TABLE 16

(SEE CONTINUATION.)

VALUES OF $S^2 \times B \times H$	Thickness of Intercostal Plate and Angle.	DEPTH OF BEAMS.					
		mm. 205		mm. 230		mm. 255	
		SIZE AND TYPE OF GIRDER.					
		Double Channels.	Double Angles.	Double Channels.	Double Angles.	Double Channels.	Double Angles.
	mm.	mm.	mm.	mm.	mm.	mm.	mm.
165	8,5		130 × 100 × 9		130 × 100 × 7,5		100 × 100 × 8
190	8,5		150 × 100 × 9,5		130 × 100 × 9		130 × 100 × 7,5
225	8,5		150 × 100 × 10,5		150 × 100 × 9,5		130 × 100 × 9
260	10		150 × 100 × 11,5		150 × 100 × 10,5		150 × 100 × 9,5
300	10		150 × 100 × 13		150 × 100 × 11,5		150 × 100 × 10,5
345	10	165 × 80 × 80 × 11,5 / 12	150 × 100 × 14		150 × 100 × 13		150 × 100 × 11,5
395	10	180 × 80 × 80 × 11,5 / 13	150 × 100 × 16,5	165 × 80 × 80 × 11,5 / 12	150 × 100 × 14		150 × 100 × 13
450	11	180 × 90 × 90 × 10,5 / 16	170 × 115 × 15	180 × 80 × 80 × 11,5 / 13	150 × 100 × 16,5	165 × 80 × 80 × 11,5 / 12	150 × 100 × 14
500	11	200 × 85 × 85 × 12 / 14	170 × 115 × 16	180 × 90 × 90 × 10,5 / 16	170 × 115 × 15	180 × 80 × 80 × 11,5 / 13	150 × 100 × 16,5
560	11	220 × 90 × 90 × 11,5 / 15	150 × 150 × 16,5	200 × 85 × 85 × 12 / 14	170 × 115 × 16	180 × 90 × 90 × 10,5 / 16	170 × 115 × 15
630	11	220 × 90 × 90 × 15 / 15	150 × 150 × 19	200 × 90 × 90 × 11,5 / 15	150 × 150 × 16,5	200 × 85 × 85 × 12 / 14	170 × 115 × 16
700	11	240 × 95 × 95 × 15 / 15,5	160 × 160 × 19,5	200 × 90 × 90 × 15 / 15	150 × 150 × 19	200 × 90 × 90 × 11,5 / 15	150 × 150 × 16,5
775	12,5	260 × 95 × 95 × 15,5 / 16	160 × 160 × 22	240 × 95 × 95 × 15 / 15,5	160 × 160 × 19,5	200 × 90 × 90 × 15 / 15	150 × 150 × 19
855	12,5	300 × 100 × 100 × 12 / 17		260 × 95 × 95 × 15,5 / 16	160 × 160 × 22	240 × 95 × 95 × 15 / 15,5	160 × 160 × 19,5
940	12,5	300 × 100 × 100 × 16 / 17		300 × 100 × 100 × 12 / 17		260 × 95 × 95 × 15,5 / 16	160 × 160 × 22
1035	12,5	300 × 100 × 100 × 12 / 17 Rider Plate 205 × 15		300 × 100 × 100 × 16 / 17		300 × 100 × 100 × 12 / 17	
1140	12,5	300 × 100 × 100 × 14,5 / 17 Rider Plate 205 × 18		300 × 100 × 100 × 12 / 17 Rider Plate 205 × 15		300 × 100 × 100 × 16 / 17	
1250	12,5	320 × 100 × 100 × 14 / 17,5 Rider Plate 230 × 18		300 × 100 × 100 × 14,5 / 17 Rider Plate 205 × 18		300 × 100 × 100 × 12 / 17 Rider Plate 205 × 15	
1370	12,5	320 × 100 × 100 × 14,5 / 17,5 Rider Plate 255 × 19		320 × 100 × 100 × 14 / 17,5 Rider Plate 230 × 18		300 × 100 × 100 × 14,5 / 17 Rider Plate 205 × 18	
1510	13,5	320 × 100 × 100 × 14,5 / 17,5 Rider Plate 255 × 21,5		320 × 100 × 100 × 14,5 / 17,5 Rider Plate 255 × 19		320 × 100 × 100 × 14 / 17,5 Rider Plate 230 × 18	
1655	13,5	320 × 100 × 100 × 15,5 / 17,5 Rider Plate 280 × 21,5		320 × 100 × 100 × 15 / 17,5 Rider Plate 280 × 20		320 × 100 × 100 × 14,5 / 17,5 Rider Plate 255 × 19	
1810	13,5						
1975	13,5						

DECK GIRDERS at HEADS of WIDELY SPACED PILLARS, CHANNELS or ANGLES.

TABLE 16 (CONCLUDED.)

VALUES OF $S^2 \times B \times H$	Thickness of Intercostal Plate and Angle.	DEPTH OF BEAMS.			
		mm. 280		mm. 305	
		SIZE AND TYPE OF GIRDER.			
		Double Channels.	Double Angles.	Double Channels.	Double Angles.
	mm.	mm.	mm.	mm.	mm.
165	8,5				
190	8,5				
225	8,5				
260	10				
300	10				
345	10		150 × 100 × 10,5		
395	10		150 × 100 × 11,5		150 × 100 × 10,5
450	11		150 × 100 × 13		150 × 100 × 11,5
500	11	165 × 80 × 80 × 11,5 / 12	150 × 100 × 14		150 × 100 × 13
560	11	180 × 80 × 80 × 11,5 / 13	150 × 100 × 16,5	165 × 80 × 80 × 11,5 / 12	150 × 100 × 14
630	11	180 × 90 × 90 × 10,5 / 16	170 × 115 × 15	180 × 80 × 80 × 11,5 / 13	150 × 100 × 16,5
700	11	200 × 85 × 85 × 12 / 14	170 × 115 × 16	180 × 90 × 90 × 10,5 / 16	170 × 115 × 15
775	12,5	200 × 90 × 90 × 11,5 / 15	150 × 150 × 16,5	200 × 85 × 85 × 12 / 14	170 × 115 × 16
855	12,5	200 × 90 × 90 × 15 / 15	150 × 150 × 19	200 × 90 × 90 × 11,5 / 15	150 × 150 × 16,5
940	12,5	240 × 95 × 95 × 15 / 15,5	160 × 160 × 19,5	200 × 90 × 90 × 15 / 15	150 × 150 × 19
1035	12,5	260 × 95 × 95 × 15,5 / 16	160 × 160 × 22	240 × 95 × 95 × 15 / 15,5	160 × 160 × 19,5
1140	12,5	300 × 100 × 100 × 12 / 17		260 × 95 × 95 × 15,5 / 16	160 × 160 × 22
1250	12,5	300 × 100 × 100 × 16 / 17		300 × 100 × 100 × 12 / 17	
1370	12,5	300 × 100 × 100 × 12 / 17 Rider Plate 205 × 15		300 × 100 × 100 × 16 / 17	
1510	13,5	300 × 100 × 100 × 14,5 / 17 Rider Plate 205 × 18		300 × 100 × 100 × 12 / 17 Rider Plate 205 × 15	
1655	13,5	320 × 100 × 100 × 14 / 17,5 Rider Plate 230 × 18		300 × 100 × 100 × 14,5 / 17 Rider Plate 205 × 18	
1810	13,5	320 × 100 × 100 × 14,5 / 17,5 Rider Plate 280 × 19		320 × 100 × 100 × 14,5 / 17,5 Rider Plate 255 × 18	
1975	13,5			320 × 100 × 100 × 14,5 / 17,5 Rider Plate 280 × 21	

DECK GIRDERS at HEADS of WIDELY SPACED PILLARS, BULB ANGLE FACE BARS.

TABLE 17

(SEE CONTINUATION.)

VALUES OF $S^2 \times B \times H$		DEPTH AND THICKNESS OF GIRDER.								
		mm. 305 × 10	mm. 330 × 10	mm. 355 × 10,5	mm. 380 × 10,5	mm. 405 × 11	mm. 430 × 11	mm. 455 × 11,5	mm. 485 × 11,5	mm. 510 × 12
165	SINGLE BULB ANGLES	220 × 75 × 12	200 × 75 × 11	180 × 75 × 10	150 × 70 × 10,5	150 × 70 × 8,5	150 × 70 × 8			
190		220 × 75 × 13	220 × 75 × 11,5	190 × 75 × 10,5	180 × 75 × 9,5	150 × 70 × 10	150 × 70 × 8			
225		220 × 75 × 14	220 × 75 × 12	190 × 75 × 11,5	180 × 75 × 10,5	180 × 75 × 10	150 × 70 × 9,5			
260		240 × 90 × 13,5	240 × 90 × 11,5	220 × 75 × 11	190 × 75 × 11	180 × 75 × 10,5	150 × 70 × 11	150 × 70 × 8,5		
300		270 × 90 × 13,5	240 × 90 × 13	220 × 75 × 13	220 × 75 × 11	190 × 75 × 11	180 × 75 × 10	150 × 70 × 10,5	150 × 70 × 8,5	
345		280 × 90 × 15	270 × 90 × 13,5	240 × 90 × 13	220 × 75 × 13,5	220 × 75 × 11	190 × 75 × 11	180 × 75 × 10	170 × 75 × 9,5	150 × 70 × 8,5
395		290 × 90 × 16,5	280 × 90 × 15	270 × 90 × 13,5	240 × 90 × 13	220 × 75 × 13,5	220 × 75 × 11,5	190 × 75 × 11,5	180 × 75 × 10,5	150 × 70 × 11
450	DOUBLE BULB ANGLES	220 × 75 × 12	300 × 95 × 16	290 × 90 × 14,5	270 × 90 × 14	240 × 90 × 13	220 × 75 × 13,5	220 × 75 × 12,5	200 × 75 × 11,5	180 × 75 × 10,5
500		220 × 75 × 13,5	220 × 75 × 13	300 × 95 × 16	290 × 90 × 15	270 × 90 × 14	240 × 90 × 13,5	220 × 75 × 14,5	220 × 75 × 12,5	200 × 75 × 12
560		240 × 90 × 13	220 × 75 × 14	220 × 75 × 13	300 × 95 × 16,5	280 × 90 × 16	270 × 90 × 14,5	250 × 90 × 14	250 × 90 × 12,5	220 × 75 × 13
630		270 × 90 × 13,5	240 × 90 × 13,5	220 × 75 × 14	220 × 75 × 13,5	300 × 95 × 17	290 × 90 × 16	280 × 90 × 14,5	250 × 90 × 15	240 × 90 × 13,5
700		280 × 90 × 15,5	270 × 90 × 14	240 × 90 × 14	240 × 90 × 12,5	220 × 75 × 13	300 × 95 × 17,5	300 × 95 × 15,5	280 × 90 × 15,5	270 × 90 × 14,5
775		300 × 95 × 16,5	290 × 90 × 16	280 × 90 × 13,5	270 × 90 × 13	230 × 90 × 13,5	220 × 75 × 13,5	220 × 75 × 13	300 × 95 × 16,5	290 × 90 × 16,5
855			300 × 95 × 17,5	300 × 95 × 15	280 × 90 × 15	250 × 90 × 15	250 × 90 × 13,5	230 × 90 × 14	220 × 75 × 13,5	220 × 75 × 13
940				300 × 95 × 18	300 × 95 × 16	280 × 90 × 15,5	280 × 90 × 14	270 × 90 × 13	240 × 90 × 13	220 × 75 × 14,5
1035					300 × 95 × 18,5	300 × 95 × 16,5	290 × 90 × 16	280 × 90 × 14,5	270 × 90 × 14	240 × 90 × 14
1140							300 × 95 × 17	290 × 90 × 16,5	280 × 90 × 15	280 × 90 × 14
1250								300 × 95 × 17	290 × 90 × 16,5	280 × 90 × 15,5
1370								300 × 95 × 18	300 × 95 × 17	300 × 95 × 15,5
1510									300 × 95 × 18,5	300 × 95 × 17
1655										
1810										
1975										
2140										
2320										
2510										
2730										
2985										

DECK GIRDERS at HEADS of WIDELY SPACED PILLARS, BULB ANGLE FACE BARS.

TABLE 17

(SEE CONTINUATION.)

VALUES OF $S^2 \times B \times H$		DEPTH AND THICKNESS OF GIRDER.							
		mm. 535 × 12	mm. 560 × 12	mm. 585 × 12,5	mm. 610 × 12,5	mm. 635 × 12,5	mm. 660 × 13	mm. 685 × 13	mm. 710 × 13,5
165	SINGLE BULB ANGLES								
190									
225									
260									
300									
345									
395		150 × 70 × 8,5							
450		150 × 70 × 11	150 × 70 × 8,5						
500		180 × 75 × 11,5	170 × 75 × 10,5	150 × 70 × 10	150 × 70 × 8				
560		200 × 75 × 12,5	190 × 75 × 11	180 × 75 × 10,5	170 × 75 × 10	150 × 70 × 8,5			
630		220 × 75 × 14	220 × 75 × 12,5	200 × 75 × 12	190 × 75 × 11	180 × 75 × 10	150 × 70 × 10	150 × 70 × 8	
700		250 × 90 × 14	240 × 90 × 12,5	220 × 75 × 13,5	220 × 75 × 11,5	190 × 75 × 11	180 × 75 × 10,5	170 × 75 × 9,5	150 × 70 × 8,5
775		280 × 90 × 15	270 × 90 × 14	240 × 90 × 14	240 × 90 × 12,5	220 × 75 × 13	200 × 75 × 12,5	190 × 75 × 11	170 × 75 × 11
855		300 × 95 × 16,5	300 × 95 × 15	280 × 90 × 14,5	270 × 90 × 13,5	240 × 90 × 13,5	220 × 75 × 14,5	220 × 75 × 13	200 × 75 × 12,5
940	DOUBLE BULB ANGLES	220 × 75 × 13,5	220 × 75 × 12	300 × 95 × 16,5	290 × 90 × 16	280 × 90 × 15	270 × 90 × 14	250 × 90 × 13,5	240 × 90 × 12,5
1035		230 × 90 × 13,5	220 × 75 × 14	220 × 75 × 13	300 × 95 × 17,5	300 × 90 × 16	290 × 90 × 16	280 × 90 × 14	270 × 90 × 13,5
1140		270 × 90 × 14,5	240 × 90 × 13,5	240 × 90 × 12,5	220 × 75 × 13,5	220 × 75 × 11,5	300 × 95 × 17	290 × 90 × 17	280 × 90 × 15
1250		280 × 90 × 15	250 × 90 × 15	240 × 90 × 14	230 × 90 × 14,5	230 × 90 × 14	220 × 75 × 13	300 × 95 × 18	300 × 95 × 16,5
1370		290 × 90 × 15,5	280 × 90 × 14,5	270 × 90 × 14	250 × 90 × 14	250 × 90 × 13	230 × 90 × 14	220 × 75 × 13,5	220 × 75 × 11
1510		300 × 95 × 16	290 × 90 × 16	280 × 90 × 14,5	270 × 90 × 14	270 × 90 × 13	240 × 90 × 13,5	240 × 90 × 12,5	220 × 75 × 13
1655		300 × 95 × 18	300 × 95 × 16,5	290 × 90 × 16	280 × 90 × 15,5	280 × 90 × 14,5	270 × 90 × 14	270 × 90 × 13	240 × 90 × 14
1810				300 × 95 × 17,5	300 × 95 × 16	290 × 90 × 16	280 × 90 × 15	280 × 90 × 15	270 × 90 × 15,5
1975					300 × 95 × 18	300 × 95 × 17	290 × 90 × 17	290 × 90 × 16	280 × 90 × 15
2140							300 × 95 × 18	300 × 95 × 16,5	290 × 90 × 17
2320									300 × 95 × 17,5
2510									
2730									
2985									

x 2

DECK GIRDERS at HEADS of WIDELY SPACED PILLARS, BULB ANGLE FACE BARS.

TABLE 17 (CONCLUDED.)

VALUES OF $S^2 \times B \times H$		DEPTH AND THICKNESS OF GIRDER.							
		mm. 735 × 13,5	mm. 760 × 14	mm. 785 × 14	mm. 815 × 14	mm. 840 × 14,5	mm. 865 × 14,5	mm. 890 × 15	mm 915 × 15
165	SINGLE BULB ANGLES								
190									
225									
260									
300									
345									
395									
450									
500									
560									
630									
700									
775		150 × 70 × 10	150 × 70 × 8,5						
855		190 × 75 × 11	170 × 75 × 11	150 × 70 × 10,5					
940		220 × 75 × 13	200 × 75 × 12,5	190 × 75 × 11	180 × 75 × 10,5	170 × 75 × 9,5	150 × 70 × 8,5		
1035		250 × 90 × 13,5	220 × 75 × 14,5	220 × 75 × 13	200 × 75 × 12,5	190 × 75 × 11	180 × 75 × 10,5	170 × 75 × 9,5	150 × 70 × 8,5
1140		280 × 90 × 13,5	250 × 90 × 14,5	240 × 90 × 13	220 × 75 × 14,5	220 × 75 × 12,5	200 × 75 × 12	190 × 75 × 11	180 × 75 × 10,5
1250		290 × 90 × 16	280 × 90 × 14	270 × 90 × 14	240 × 90 × 14	240 × 90 × 12,5	220 × 75 × 13,5	220 × 75 × 12	190 × 75 × 12
1370		300 × 95 × 16,5	300 × 95 × 15	290 × 90 × 15,5	280 × 90 × 13	250 × 90 × 14,5	250 × 90 × 13	220 × 75 × 14	220 × 75 × 12,5
1510	DOUBLE BULB ANGLES	220 × 75 × 12,5	300 × 95 × 17	290 × 90 × 17	290 × 90 × 15,5	280 × 90 × 14	270 × 90 × 13,5	240 × 90 × 14	240 × 90 × 12,5
1655		240 × 90 × 12	220 × 75 × 13,5	220 × 75 × 11,5	300 × 95 × 17,5	290 × 90 × 17	290 × 90 × 16	280 × 90 × 14	270 × 90 × 14
1810		250 × 90 × 14	230 × 90 × 14,5	220 × 75 × 14,5	220 × 75 × 13,5	220 × 75 × 11,5	300 × 95 × 17,5	290 × 90 × 17	290 × 90 × 16
1975		280 × 90 × 14	270 × 90 × 13,5	240 × 90 × 14	230 × 90 × 14,5	220 × 75 × 14,5	220 × 75 × 13,5	220 × 75 × 11,5	300 × 95 × 17,5
2140		290 × 90 × 16	280 × 90 × 14,5	270 × 90 × 14	270 × 90 × 13	240 × 90 × 14	230 × 90 × 14,5	220 × 75 × 14,5	220 × 75 × 13,5
2320		300 × 95 × 16,5	290 × 90 × 16,5	280 × 90 × 15,5	280 × 90 × 14,5	270 × 90 × 14,5	270 × 90 × 13,5	240 × 90 × 14	230 × 90 × 14,5
2510		300 × 95 × 18,5	300 × 95 × 17,5	300 × 95 × 16,5	290 × 90 × 16,5	280 × 90 × 15,5	280 × 90 × 14,5	270 × 90 × 14,5	270 × 90 × 13,5
2730				300 × 95 × 18,5	300 × 95 × 17	300 × 95 × 16,5	290 × 90 × 16,5	280 × 90 × 15,5	280 × 90 × 14,5
2985							300 × 95 × 17,5	300 × 95 × 16,5	300 × 95 × 15,5

SHELL PLATING.

FULL SCANTLING VESSELS.

TABLE 18

FIRST LONGITUDINAL NUMERAL. L × D	BREADTH OF FLAT PLATE KEEL AND GARBOARD STRAKE.	THICKNESS OF FLAT KEEL PLATE.		THICKNESS OF GARBOARD STRAKE WITH BAR KEEL.		THICKNESS OF SHELL PLATING.				
						From Flat Plate Keel or Garboard Strake to Upper Turn of Bilge.		From Upper Turn of Bilge to Strake Below Sheerstrake.		Propeller Boss Plates.
		For $\frac{3}{5}$-Length Amids.	At Ends.	For $\frac{1}{2}$-Length Amids.	At Ends.	For $\frac{1}{2}$-Length Amids.	At Ends.	For $\frac{1}{2}$-Length Amids.	At Ends.	
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
75	890	9,5	8,5	7,5	6,5	7	6	7	6	7
100	915	10	9	8	7	7,5	6,5	7,5	6,5	7,5
135	940	10,5	9,5	8,5	7,5	8	7	8	7	8
175	965	11	10	9,5	8,5	8,5	7,5	8,5	7,5	8,5
225	990	11,5	10,5	10	9	9	8	9	8	9
270	1015	12	11	10,5	9,5	9,5	8,5	9,5	8,5	9,5
325	1040	12,5	11,5	11	10	10	9	10	9	10
390	1065	13	12	12	10,5	10,5	9,5	10,5	9,5	10,5
455	1090	13,5	12,5	12,5	11	11	9,5	11	9,5	11,5
525	1120	14,5	13,5	13	11,5	11,5	10	11,5	10	12,5
600	1145	15	14	13,5	12	12	10	12	10	13,5
680	1170	16	14,5	14	12,5	12,5	10,5	12,5	10	14
760	1180	17	15	14,5	12,5	13	10,5	13	10,5	15
845	1195	17,5	15,5	15	13	13,5	11	13,5	10,5	15,5
930	1220	18,5	16,5			14	11	14	10,5	16,5
1020	1230	19	17			14,5	11,5	14,5	11	17
1115	1245	20	17,5			15	11,5	15	11	18
1210	1270	20,5	18			15,5	12	15,5	11,5	18,5
1300	1295	21,5	19			16,5	12	16,5	11,5	19
1400	1320	22	19,5			17,5	12,5	17	11,5	19,5
1505	1345	22,5	20,5			18	12,5	17,5	12	20
1615	1370	23,5	21			18,5	13	18	12	20,5
1730	1395	24	21,5			19	13	18,5	12,5	21
1840	1425	25	22			19,5	13,5	19	12,5	22
1960	1455	25,5	22,5			20	14	19,5	13	22,5
2080	1485	26	23			21	14	20	13	23
2210	1515	27	24			21,5	14,5	20,5	13,5	23,5
2340	1545	28	25			22	15	21	14	24
2480	1575	28,5	26			22,5	15	21,5	14	24,5

SHELL PLATING.

COMPLETE SUPERSTRUCTURE VESSELS.

TABLE 19

FIRST LONGITUDINAL NUMERAL. L×D	BREADTH OF FLAT PLATE KEEL AND GARBOARD STRAKE.	THICKNESS OF FLAT KEEL PLATE.		THICKNESS OF GARBOARD STRAKE WITH BAR KEEL.		THICKNESS OF SHELL PLATING.				
						From Flat Plate Keel or Garboard Strake to Upper Turn of Bilge.		From Upper Turn of Bilge to Strake Below Sheerstrake.		Propeller Boss Plates.
		For $\frac{3}{5}$ Length Amids.	At Ends.	For $\frac{1}{2}$-Length Amids.	At Ends.	For $\frac{1}{2}$-Length Amids.	At Ends.	For $\frac{1}{2}$-Length Amids.	At Ends.	
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
325	1040	11	10	10	9,5	9,5	9	9,5	9	10
390	1065	11,5	10,5	10,5	10	10	9,5	10	9,5	10,5
455	1090	12	11	11	10	10,5	9,5	10,5	9,5	11,5
525	1120	12,5	11,5	11,5	10,5	11	10	11	10	12,5
600	1145	13	12	12	10,5	11	10	11	10	13,5
680	1170	14	13	12,5	11	11,5	10,5	11,5	10	14
760	1180	14,5	13,5	13	11,5	12	10,5	12	10,5	14
845	1195	15	14	13,5	12	12,5	11	12,5	10,5	14
930	1220	16,5	14,5			13	11	13	10,5	15
1020	1230	17	15			13	11,5	13	11	15
1115	1245	18	15,5			13,5	11,5	13,5	11	15,5
1210	1270	18,5	16,5			14	12	14	11,5	16,5
1300	1295	19,5	17			14,5	12	14,5	11,5	17
1400	1320	20	17,5			15	12,5	15	11,5	18
1505	1345	20,5	18			15,5	12,5	15,5	12	18,5
1615	1370	21,5	19			16,5	13	16,5	12	19
1730	1395	22	19,5			17,5	13	17	12,5	19,5
1840	1425	23	20,5			18	13,5	17,5	12,5	20
1960	1455	23,5	21			18,5	14	18	13	20,5
2080	1485	24	21,5			19	14	18,5	13	21
2210	1515	24,5	22			19,5	14,5	19	13,5	22
2340	1545	25,5	22,5			20,5	15	19,5	14	22,5
2480	1580	26	23			21	15	20	14	23
2620	1615	27	24			21,5	15,5	20	14,5	23
2770	1650	27,5	24,5			22	16	20,5	14,5	23,5
2920	1685	28,5	26			22,5	16,5	21	15	24
3060	1720	29	26,5			23	16,5	21,5	15	24,5

TOPSIDE SCANTLINGS.

FULL SCANTLING VESSELS.

TABLE 20

(SEE CONTINUATION.)

SECOND LONGITUDINAL NUMERAL. L×(B+D)	BREADTH OF		PROPORTION OF LENGTH OF VESSEL TO DEPTH TO UPPER DECK. 10												
			THICKNESSES FOR ½ LENGTH AMIDSHIPS.												
					UPPER DECK.										
					FLUSH DECK VESSELS.										
					When One Deck is Fitted.		When Two Decks are Fitted.				When Three Decks are Fitted.		Increase to Stringer Plate, Deck Plating and Tie Plates for Vessels having 100 per Cent. Superstructures.	Deck Plating within Line of Deck Openings.	Minimum for Unsheathed Deck Plating abreast Deck Openings.
							2nd Deck of Stringers and Tie Plates.		2nd Deck of Steel.		2nd and 3rd Decks of Steel.				
	Sheer-strake and Strake below.	Stringer Plate.	Sheer-strake.	Strake below Sheer-strake.	Stringer Plate.	Tie Plates and Deck Plating.	Stringer Plate.	Tie Plates and Deck Plating.	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.			
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
140	1015		7	7	380× 7,5	255× 7,5							0,5		
185	1015		7,5	7,5	380× 7,5	255× 7,5							0,5		
230	1040		7,5	7,5	405× 7,5	255× 7,5							0,5		
280	1040		8	8	430× 7,5	255× 7,5							0,5		
325	1040		8	8	455× 8	255× 8							0,5		
370	1065		8,5	8,5	480× 8	255× 8							0,5		
420	1065		8,5	8,5	510× 8	255× 8							0,5		
465	1090		9	9	535× 8,5	255× 8,5							0,5		
535	1090		9	9	585× 8,5	280× 8,5							0,5		
605	1120		9,5	9,5	635× 9	305× 9							1		
675	1120		9,5	9,5	685× 9	330× 9							1,5		
745	1120		10	10	760× 9	355× 9							2		
835	1145		10,5	10,5	815× 9,5	380× 9,5							2,5		
930	1145	1145	10,5	10,5	865× 9,5	405× 9,5							3,5	7,5	8
1020	1145	1145	11	11	965×10	430×10							4	7,5	8
1115	1170	1145	11,5	11	1065×10,5	510×10,5	1065×10,5	305×10,5	8,5				4	7,5	8
1210	1170	1145	12	11,5	1120×11	510×11	1065×11	355×11	8,5				4,5	7,5	8
1300	1170	1145	12,5	12	1220×11,5	585×11,5	1065×11,5	405×11,5	9,5				4,5	7,5	8
1395	1195	1145	12,5	12	1270×12	635×12	1120×11,5	455×11,5	10				5	7,5	8
1485	1195	1145	13	12,5	1270×12	710×12	1145×12	510×12	10				5,5	7,5	8,5
1580	1195	1145	13	12,5	1320×12,5	815×12,5	1220×12	585×12	10				5,5	7,5	8,5
1670	1220	1145	13,5	13	1395×12,5	940×12,5	1270×12,5	710×12,5	10,5		10		5,5	7,5	8,5
1765	1220	1145	13,5	13	1395×12,5	1195×12,5	1345×12,5	865×12,5	10,5		10		5,5	8	8,5
1860	1220	1170	13,5	13	10,5	7,5	10,5	7,5	10,5		10		3,5	8	9
1950	1220	1195	14	13,5	11,5	7,5	11	7,5	11		10,5		3,5	8	9
2045	1220	1220	14	13,5	12,5	8	11	7,5	11		10,5		3,5	8	9
2135	1245	1245	14,5	14	13	8,5	11,5	7,5	11		10,5		3,5	8	9,5
2230	1245	1270	14,5	14	13	9	12,5	7,5	11		11		3,5	8,5	9,5

TOPSIDE SCANTLINGS.

FULL SCANTLING VESSELS.

TABLE 20

(SEE CONTINUATION.)

SECOND LONGITUDINAL NUMERAL. L×(B+D)	BREADTH OF		PROPORTION OF LENGTH OF VESSEL TO DEPTH TO UPPER DECK. 10												
			THICKNESSES FOR ½ LENGTH AMIDSHIPS.												
					UPPER DECK.										
					FLUSH DECK VESSELS.										
					When One Deck is Fitted.		When Two Decks are Fitted.				When Three Decks are Fitted.		Increase to Stringer Plate, Deck Plating and Tie Plates for Vessels having 100 per Cent. Superstructures.	Deck Plating within Line of Deck Openings.	Minimum for Unsheathed Deck Plating abreast Deck Openings.
							2nd Deck of Stringers and Tie Plates.		2nd Deck of Steel.		2nd and 3rd Decks of Steel.				
	Sheer-strake and Strake below.	Stringer Plate.	Sheer-strake.	Strake below Sheer-strake.	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating			
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
2370	1245	1295	15	14,5	13,5	10	13	8,5	11,5		11		3,5	8,5	9,5
2510	1245	1320	15,5	15	14	10,5	14	9	11,5	7,5	11,5	7,5	3,5	8,5	10
2650	1270	1345	16	15,5	14	11,5	14	10	12,5	7,5	11,5	7,5	3,5	9	10
2785	1270	1370	16,5	15,5	14,5	12,5	14,5	11	13,5	7,5	12,5	7,5	4	9	10,5
2925	1270	1395	17	16	14,5	13,5			14	7,5	13,5	7,5	4	9	10,5
3060	1270	1420	17	16,5	15	14,5			15	8,5	14	8	4	9	10,5
3200	1270	1450	17,5	17	15,5	15,5			15	9,5	15	8,5	4	9,5	11
3340	1270	1475	17,5	17	16,5	16,5			15	10,5	15	9	4	9,5	11
3480	1295	1500	18	17,5	17,5	17,5			15	11	15	9,5	4	10	11
3620	1295	1525	18	17,5	18,5	18,5			15,5	11,5	15,5	10	4	10	11
3760	1295	1550	18,5	18	19	19			15,5	12,5	15,5	10,5	4	10	11,5
3900	1295	1575	18,5	18	20	20			16	13	16	11	4	10	11,5
4040	1295	1600	19	18,5	21	21			16,5	14	16,5	12	4	10,5	11,5
4180	1320	1625	19	18,5	21,5	21,5			17	14,5	17	12,5	4	10,5	11,5
4320	1320	1650	19	18,5					17	15,5	17	13	4	10,5	11,5
4460	1320	1675	19,5	19					17,5	16,5	17,5	13,5	4	10,5	12
4640	1320	1725	19,5	19					18	17,5	17,5	14,5	4	11	12
4830	1345	1755	20	19,5					18,5	18	18	15	4	11	12
5020	1345	1780	20,5	20					19	19	18,5	16,5	4	11	12
5200	1345	1830	21	20,5					19,5	19,5	19	17	4	11,5	12
5390	1370	1880	21	20,5					20,5	20,5	19	18	4	11,5	12
5570	1370	1930	21,5	21					21	21	19,5	19	4	11,5	12
5760	1370	1955	21,5	21					21,5	21,5	19,5	20	4	12	12
5950	1395	2005	22	21,5					22	22	20,5	20,5	4	12	12
6130	1395	2030	22,5	22					22,5	22,5	21,5	21,5	4	12	12
6320	1420	2055	22,5	22					23	23	22	22	4	12	12
6500	1420	2110	23	22,5					24	24	23	23	4	12,5	12,5

TOPSIDE SCANTLINGS.

FULL SCANTLING VESSELS.

TABLE 20

(SEE CONTINUATION.)

SECOND LONGITUDINAL NUMERAL. $L\times(B+D)$	BREADTH OF		PROPORTION OF LENGTH OF VESSEL TO DEPTH TO UPPER DECK. 11												
			THICKNESSES FOR $\frac{1}{2}$ LENGTH AMIDSHIPS.												
					UPPER DECK.										
					FLUSH DECK VESSELS.										
					When One Deck is Fitted.		When Two Decks are Fitted.				When Three Decks are Fitted.				
							2nd Deck of Stringers and Tie Plates.		2nd Deck of Steel.		2nd and 3rd Decks of Steel.				
	Sheer-strake and Strake below.	Stringer Plate.	Sheer-strake.	Strake below Sheer-strake.	Stringer Plate.	Tie Plates and Deck Plating.	Stringer Plate.	Tie Plates and Deck Plating.	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.	Increase to Stringer Plate, Deck Plating and Tie Plates for Vessels having 100 per Cent. Super-structures.	Deck Plating within Line of Deck Openings.	Minimum for Unsheathed Deck Plating abreast Deck Openings.
	mm.	mm.	mm.	mm	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
140	1015		7,5	7,5	380 × 7,5	255 × 7,5							0,5		
185	1015		7,5	7,5	405 × 7,5	255 × 7,5							0,5		
230	1040		8	8	430 × 8	255 × 8							0,5		
280	1040		8	8	455 × 8	255 × 8							0,5		
325	1040		8,5	8	480 × 8	255 × 8							0,5		
370	1065		9	8,5	510 × 8,5	255 × 8,5							0,5		
420	1065		9	9	560 × 8,5	255 × 8,5							0,5		
465	1090		9,5	9,5	610 × 9	255 × 9							0,5		
535	1090		9,5	9,5	660 × 9	280 × 9							0,5		
605	1120		10	10	710 × 9	305 × 9							1		
675	1120		10	10	760 × 9	330 × 9							1,5		
745	1120		10,5	10,5	815 × 9,5	355 × 9,5							2		
835	1145		11	10,5	890 × 10	380 × 10							2,5		
930	1145	1145	11	10,5	965 × 10	405 × 10							3,5	7,5	8
1020	1145	1145	11,5	11	1015 × 10,5	455 × 10,5							4	7,5	8
1115	1170	1145	12	11,5	1120 × 11	510 × 11	1065 × 11	405 × 11	9				4,5	7,5	8
1210	1170	1145	12,5	12	1195 × 11,5	510 × 11,5	1090 × 11	480 × 11	9				4,5	7,5	8
1300	1170	1145	13	12	1270 × 12	635 × 12	1145 × 11,5	610 × 11,5	9,5				5	7,5	8
1395	1195	1145	13	12	1345 × 12	815 × 12	1195 × 12	660 × 12	9,5				5	7,5	8
1485	1195	1145	13,5	12,5	1395 × 12,5	990 × 12,5	1270 × 12,5	710 × 12,5	10				5,5	7,5	8
1580	1195	1145	13,5	12,5	11	7,5	10	7,5	10				3,5	8	8,5
1670	1220	1145	14	13	12	7,5	10,5	7,5	10		10		3,5	8	8,5
1765	1220	1170	14	13	12,5	8,5	11,5	7,5	10,5		10		3,5	8	8,5
1860	1220	1170	14	13	13	9	12,5	7,5	10,5		10		3,5	8	8,5
1950	1220	1195	14,5	13,5	13	9,5	12,5	8	11	7,5	10,5	7,5	3,5	8	9
2045	1220	1220	14,5	13,5	13	10,5	13	8,5	11	7,5	10,5	7,5	3,5	8,5	9
2135	1245	1245	15	14	13,5	11	13,5	9	12,5	7,5	11	7,5	3,5	8,5	9
2230	1245	1270	15,5	14,5	14	11,5	14	9,5	13,5	7,5	12,5	7,5	3,5	8,5	9,5

TOPSIDE SCANTLINGS.

FULL SCANTLING VESSELS.

TABLE 20

(SEE CONTINUATION.)

SECOND LONGITUDINAL NUMERAL. $L \times (B+D)$	BREADTH OF		PROPORTION OF LENGTH OF VESSEL TO DEPTH TO UPPER DECK. 11												
			THICKNESSES FOR $\frac{1}{2}$ LENGTH AMIDSHIPS.												
					UPPER DECK.										
					FLUSH DECK VESSELS.										
					When One Deck is Fitted.		When Two Decks are Fitted.				When Three Decks are Fitted.		Increase to Stringer Plate, Deck Plating and Tie Plates for Vessels having 100 per Cent. Super-structures.	Deck Plating within Line of Deck Openings.	Minimum for Unsheathed Deck Plating abreast Deck Openings.
							2nd Deck of Stringers and Tie Plates.		2nd Deck of Steel.		2nd and 3rd Decks of Steel.				
	Sheer-strake and Strake below.	Stringer Plate.	Sheer-strake.	Strake below Sheer-strake.	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.			
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
2370	1245	1295	16,5	15	14,5	12,5	14,5	10,5	14	8	13,5	7,5	3,5	8,5	9,5
2510	1245	1320	17	15,5	15	13,5	15	11,5	15	8,5	15	7,5	3,5	9	9,5
2650	1270	1345	17,5	15,5	15	14,5	15	12,5	15	9,5	15	8,5	3,5	9	10
2785	1270	1370	17,5	16,5	15,5	15,5	15,5	13,5	15,5	10	15,5	9	4	9	10
2925	1270	1395	18	17	17	16,5			15,5	11	15,5	10	4	9,5	10,5
3060	1270	1420	18	17	17,5	17,5			16	11,5	16	10,5	4	9,5	10,5
3200	1270	1450	18,5	17,5	18,5	18			16,5	12,5	16,5	11,5	4	9,5	10,5
3340	1270	1475	19	17,5	19	19			17	13,5	17	12	4	10	11
3480	1295	1500	19	17,5	19,5	19,5			17	14,5	17	13	4	10	11
3620	1295	1525	19,5	18	20,5	20,5			17,5	15	17,5	13,5	4	10	11
3760	1295	1550	20	18,5	21	21			17,5	16	17,5	14,5	4	10	11
3900	1295	1575	20	18,5	22	22			18	17	18	15	4	10,5	11,5
4040	1295	1600	20,5	19	22,5	22,5			18,5	17,5	18	16	4	10,5	11,5
4180	1320	1625	21	19,5	23,5	23,5			19	18,5	18,5	17	4	10,5	11,5
4320	1320	1650	21	19,5					19,5	19,5	18,5	18	4	10,5	12
4460	1320	1675	21,5	20					20	20	19	18,5	4	10,5	12
4640	1320	1725	21,5	20,5					21	21	19,5	19,5	4	11	12
4830	1345	1755	22	20,5					21,5	21,5	20	20	4	11	12
5020	1345	1780	22,5	21					22	22	20,5	20,5	4	11	12
5200	1345	1830	23	21,5					22,5	22,5	21	21	4	11,5	12
5390	1370	1880	23	21,5					23	23	21,5	21,5	4	11,5	12
5570	1370	1930	23,5	22					24	24	22	22	4	11,5	12
5760	1370	1955	23,5	22					24,5	24,5	23	23	4,5	12	12
5950	1395	2005	24	22,5					25,5	25,5	23,5	23,5	4,5	12	12
6130	1395	2030	24,5	23					26,5	26,5	24,5	24,5	4,5	12	12
6320	1420	2055	24,5	23					27	27	25	25	4,5	12	12
6500	1420	2110	25	23,5					28	28	26	26	4,5	12,5	12,5

TOPSIDE SCANTLINGS.
FULL SCANTLING VESSELS.

TABLE 20
(SEE CONTINUATION.)

SECOND LONGITUDINAL NUMERAL. $L \times (B+D)$	BREADTH OF		PROPORTION OF LENGTH OF VESSEL TO DEPTH TO UPPER DECK. 12												
			THICKNESSES FOR $\frac{1}{2}$ LENGTH AMIDSHIPS.												
					UPPER DECK.										
					FLUSH DECK VESSELS.										
					When One Deck is Fitted.		When Two Decks are Fitted.				When Three Decks are Fitted.		Increase to Stringer Plate, Deck Plating and Tie Plates for Vessels having 100 per Cent. Superstructures.	Deck Plating within Line of Deck Openings.	Minimum for Unsheathed Deck Plating abreast Deck Openings.
							2nd Deck of Stringers and Tie Plates.		2nd Deck of Steel.		2nd and 3rd Decks of Steel.				
	Sheer-strake and Strake below.	Stringer Plate.	Sheer-strake.	Strake below Sheer-strake.	Stringer Plate.	Tie Plates and Deck Plating.	Stringer Plate.	Tie Plates and Deck Plating.	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.			
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
140	1015		7,5	7,5	405 × 7,5	255 × 7,5							0,5		
185	1015		7,5	7,5	430 × 7,5	255 × 7,5							0,5		
230	1040		8	7,5	455 × 8	255 × 8							0,5		
280	1040		8,5	8	480 × 8	255 × 8							0,5		
325	1040		8,5	8	535 × 8,5	255 × 8,5							0,5		
370	1065		9	8,5	585 × 8,5	255 × 8,5							0,5		
420	1065		9,5	9	635 × 9	255 × 9							0,5		
465	1090		10	9,5	685 × 9	280 × 9							0,5		
535	1090		10	9,5	735 × 9	305 × 9							0,5		
605	1120		10,5	10	785 × 9,5	330 × 9,5							1		
675	1120		10,5	10	840 × 9,5	355 × 9,5							1,5		
745	1120		11	10,5	915 × 9,5	380 × 9,5							2		
835	1145		11,5	11	965 × 10	405 × 10							2,5		
930	1145	1145	11,5	11	1015 × 10	455 × 10							3,5	7,5	8
1020	1145	1145	12	11,5	1065 × 10,5	510 × 10,5							4	7,5	8
1115	1170	1145	12,5	11,5	1120 × 11	560 × 11	1065 × 11	430 × 11	9,5				4,5	7,5	8
1210	1170	1145	13	12	1195 × 12	560 × 12	1120 × 11	480 × 11	9,5				4,5	7,5	8
1300	1170	1145	13,5	12,5	1270 × 12,5	635 × 12,5	1170 × 11,5	610 × 11,5	9,5				5	7,5	8
1395	1195	1145	13,5	12,5	1370 × 12,5	815 × 12,5	1220 × 12	660 × 12	10				5	8	8
1485	1195	1145	14	13	1475 × 12,5	990 × 12,5	1320 × 12,5	710 × 12,5	10				5,5	8	8
1580	1195	1145	14	13	12,5	7,5	10,5	7,5	10				3,5	8	8,5
1670	1220	1145	14,5	13,5	13	7,5	11,5	7,5	10,5		10		3,5	8,5	8,5
1765	1220	1170	14,5	13,5	13	8,5	12,5	7,5	11		10,5		3,5	8,5	8,5
1860	1220	1170	15	14	13,5	9	13,5	7,5	11,5	7,5	11	7,5	3,5	8,5	8,5
1950	1220	1195	15,5	14,5	14	9,5	13,5	8	12,5	7,5	12	7,5	3,5	8,5	9
2045	1220	1220	15,5	14,5	14,5	10,5	14	9	13	7,5	13	7,5	4	9	9
2135	1245	1245	16,5	15	14,5	11,5	14,5	9,5	14	7,5	13,5	7,5	4	9	9
2230	1245	1270	17	15	15	12	15	10,5	14,5	8	14,5	8	4	9	9,5

TOPSIDE SCANTLINGS.

FULL SCANTLING VESSELS.

TABLE 20

(SEE CONTINUATION.)

SECOND LONGITUDINAL NUMERAL. L×(B+D)	BREADTH OF		PROPORTION OF LENGTH OF VESSEL TO DEPTH TO UPPER DECK. 12												
			THICKNESSES FOR ½ LENGTH AMIDSHIPS.												
					UPPER DECK.										
					FLUSH DECK VESSELS.										
					When One Deck is Fitted.		When Two Decks are Fitted.				When Three Decks are Fitted.		Increase to Stringer Plate, Deck Plating and Tie Plates for Vessels having 100 per Cent. Super-structures.	Deck Plating within Line of Deck Openings.	Minimum for Unsheathed Deck Plating abreast Deck Openings.
							2nd Deck of Stringers and Tie Plates.		2nd Deck of Steel.		2nd and 3rd Decks of Steel.				
	Sheer-strake and Strake below.	Stringer Plate.	Sheer-strake.	Strake below Sheer-strake.	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.			
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
2370	1245	1295	17,5	15,5	15,5	13	15,5	11,5	15	9	14,5	9	4,5	9,5	9,5
2510	1245	1320	18	16	16	14	16	13	15,5	10	15	9,5	4,5	9,5	9,5
2650	1270	1345	18,5	16,5	16,5	15	16	14,5	16	11	15	10,5	4,5	9,5	10
2785	1270	1370	18,5	17	17	17	16,5	15,5	16,5	11,5	15,5	11	4,5	9,5	10
2925	1270	1395	19	17,5	18	18			17	12	16,5	11,5	5	10	10,5
3060	1270	1420	19,5	17,5	19	18,5			17,5	12,5	17,5	11,5	5	10	10,5
3200	1270	1450	20	18	19,5	19,5			18	13,5	18	12,5	5	10	10,5
3340	1270	1475	20,5	18,5	20	20			18	14,5	18	13,5	5	10	11
3480	1295	1500	20,5	18,5	21	21			18,5	15	18,5	14,5	5	10,5	11
3620	1295	1525	21	19	22	22			18,5	16	18,5	15	5	10,5	11
3760	1295	1550	21,5	19,5					19	17	19	15,5	5	10,5	11
3900	1295	1575	22	19,5					19	18	19	16,5	5	10,5	11,5
4040	1295	1600	22,5	20					19,5	18,5	19,5	17,5	5	11	11,5
4180	1320	1625	23	20,5					20	19,5	20	18	5	11	11,5
4320	1320	1650	23	20,5					20,5	20	20,5	18,5	5	11	12
4460	1320	1675	23,5	21					20,5	20,5	20,5	19	5	11	12
4640	1320	1725	23,5	21,5					21,5	21,5	21	20	5	11,5	12
4830	1345	1755	24	21,5					22	22	21	21	5	11,5	12
5020	1345	1780	24,5	22					23	23	21,5	21,5	5	11,5	12
5200	1345	1830	25	22,5					24	24	22	22	5	11,5	12
5390	1370	1880	25	22,5					25	24,5	23	23	5	11,5	12
5570	1370	1930	25,5	23					25,5	25,5	24	24	5	12	12
5760	1370	1955	25,5	23					26,5	26,5	25	25	5	12	12
5950	1395	2005	26	23,5					28	28	25,5	25,5	5	12	12
6130	1395	2030	26,5	24					29	29	26,5	26,5	5	12,5	12,5
6320	1420	2055	26,5	24					30	30	27,5	27,5	5	12,5	12,5
6500	1420	2110	27	24,5					31	31	28,5	28,5	5	12,5	12,5

TOPSIDE SCANTLINGS.

FULL SCANTLING VESSELS.

TABLE 20

(SEE CONTINUATION.)

SECOND LONGITUDINAL NUMERAL. L×(B+D)	BREADTH OF		PROPORTION OF LENGTH OF VESSEL TO DEPTH TO UPPER DECK. 13														
			THICKNESSES FOR ½ LENGTH AMIDSHIPS.														
					UPPER DECK.												
					FLUSH DECK VESSELS.												
					When One Deck is Fitted.		When Two Decks are Fitted.				When Three Decks are Fitted.		Increase to Stringer Plate, Deck Plating and Tie Plates for Vessels having 100 per Cent. Superstructures.	Deck Plating within Line of Deck Openings.	Minimum for Unsheathed Deck Plating abreast Deck Openings.
							2nd Deck of Stringers and Tie Plates.		2nd Deck of Steel.		2nd and 3rd Decks of Steel.				
	Sheer-strake and Strake below.	Stringer Plate.	Sheer-strake.	Strake below Sheer-strake.	Stringer Plate.	Tie Plates and Deck Plating.	Stringer Plate.	Tie Plates and Deck Plating.	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.			
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
140	1015		8	8	480× 7,5	255× 7,5							0,5		
185	1015		8,5	8	510× 8	255× 8							0,5		
230	1040		8,5	8	560× 8	255× 8							0,5		
280	1040		9	8,5	610× 8,5	255× 8,5							0,5		
325	1040		9	8,5	610× 8,5	255× 8,5							0,5		
370	1065		9,5	9	660× 9	255× 9							0,5		
420	1065		10	9	710× 9	255× 9							0,5		
465	1090		10,5	9,5	760× 9,5	280× 9,5							0,5		
535	1090		10,5	9,5	815× 9,5	305× 9,5							0,5		
605	1120		11	10	865×10	330×10							1		
675	1120		11	10,5	915×10	355×10							1,5		
745	1120		11,5	11	990×10	380×10							2		
835	1145		12	11	1040×10,5	405×10,5							2,5		
930	1145	1145	12,5	11,5	1090×11	455×11							3,5	7,5	8
1020	1145	1145	13	12	1090×11,5	510×11,5							4	7,5	8
1115	1170	1145	13,5	12	1170×11,5	560×11,5	1065×11	455×11	10				4,5	7,5	8
1210	1170	1145	14	12,5	1220×12	585×12	1120×11	535×11	10				4,5	7,5	8
1300	1170	1145	14,5	12,5	1270×12,5	760×12,5	1170×11,5	635×11,5	10,5				5	7,5	8
1395	1195	1145	15	13	1370×12,5	840×12,5	1245×12	735×12	10,5				5	8	8
1485	1195	1145	15,5	13,5	11,5	7,5	10,5	7,5	10,5				3,5	8	8
1580	1195	1145	16	14	12,5	7,5	11,5	7,5	11				3,5	8,5	8,5
1670	1220	1145	16,5	14	13	8	12	7,5	11	7,5	10,5		3,5	8,5	8,5
1765	1220	1170	17	14,5	14	8,5	13,5	7,5	11,5	7,5	11		3,5	8,5	8,5
1860	1220	1170	17,5	14,5	15	9	14,5	8	12,5	7,5	12	7,5	4	9	9
1950	1220	1195	18	15	15,5	9,5	15	8,5	13,5	7,5	13	7,5	4	9	9
2045	1220	1220	18,5	15,5	16	10,5	15,5	9	14,5	7,5	14	7,5	4	9,5	9,5
2135	1245	1245	19	16,5	16,5	11,5	16,5	9,5	15,5	8	15	8	4,5	9,5	9,5
2230	1245	1270	19,5	17	17	12	17	10	16	9	16	8,5	4,5	9,5	9,5

TOPSIDE SCANTLINGS.

FULL SCANTLING VESSELS.

TABLE 20

(SEE CONTINUATION.)

PROPORTION OF LENGTH OF VESSEL TO DEPTH TO UPPER DECK.

13

THICKNESSES FOR $\frac{1}{2}$ LENGTH AMIDSHIPS.

SECOND LONGITUDINAL NUMERAL. L×(B+D)	BREADTH OF		UPPER DECK.												
					FLUSH DECK VESSELS.										
					When One Deck is Fitted.		When Two Decks are Fitted.				When Three Decks are Fitted.		Increase to Stringer Plate, Deck Plating and Tie Plates for Vessels having 100 per Cent. Superstructures.	Deck Plating within Line of Deck Openings.	Minimum for Unsheathed Deck Plating abreast Deck Openings.
	Sheerstrake and Strake below.	Stringer Plate.	Sheerstrake.	Strake below Sheerstrake.			2nd Deck of Stringers and Tie Plates.		2nd Deck of Steel.		2nd and 3rd Decks of Steel.				
					Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.			
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
2370	1245	1295	20	17	17,5	13	17,5	11,5	17	9,5	16,5	9	5	9,5	9,5
2510	1245	1320	20,5	17,5	18	14	18	13	17,5	10	17,5	9,5	5	10	10
2650	1270	1345	21	17,5	18,5	15	18	14,5	17,5	11	18	10,5	5	10	10
2785	1270	1370	21,5	18,5	18,5	16,5	18,5	15,5	18,5	11,5	18,5	11	5,5	10	10
2925	1270	1395	22	19	19,5	18			19	12,5	19	11,5	5,5	10,5	10,5
3060	1270	1420	22,5	19	20	19			19,5	13,5	19,5	12,5	5,5	10,5	10,5
3200	1270	1450	23	19,5	20,5	20			20	14,5	20	13,5	5,5	10,5	10,5
3340	1270	1475	23,5	20	21	20,5			20,5	15,5	20	14,5	6	10,5	10,5
3480	1295	1500	23,5	20,5					20,5	16,5	20,5	15,5	6	11	11
3620	1295	1525	24	21					21,5	17,5	21,5	16,5	6	11	11
3760	1295	1550	24,5	21					21,5	18	21,5	17	6	11	11
3900	1295	1575	25	21					22	18,5	22	17,5	6	11,5	11,5
4040	1295	1600	25,5	21,5					22,5	19,5	22,5	18,5	6	11,5	11,5
4180	1320	1625	26	22					23	20,5	23	19	6	11,5	11,5
4320	1320	1650	26	22,5					23,5	21	23,5	19,5	6	11,5	11,5
4460	1320	1675	26,5	23					23,5	21,5	23,5	20,5	6	12	12
4640	1320	1725	27	23,5					24,5	22,5	24	21	6	12	12
4830	1345	1755	27,5	23,5					25	23,5	24,5	21,5	6	12	12
5020	1345	1780	28	24					25,5	24,5	25	22,5	6	12	12
5200	1345	1830	28,5	24,5					26	25,5	25,5	23,5	6	12	12
5390	1370	1880	29	24,5					26,5	26,5	26	24,5	6	12,5	12,5
5570	1370	1930	29,5	25					27,5	27,5	27	25,5	6	12,5	12,5
5760	1370	1955	29,5	25,5					28,5	28,5	28	26,5	6	12,5	12,5
5950	1395	2005	30	26					29,5	29,5	29	27,5	6	12,5	12,5
6130	1395	2030	30,5	26,5					30,5	30,5	30	28,5	6	12,5	12,5
6320	1420	2055	31	27							31	29,5	6	12,5	12,5
6500															

TOPSIDE SCANTLINGS.

FULL SCANTLING VESSELS.

TABLE 20

(SEE CONTINUATION.)

SECOND LONGITUDINAL NUMERAL. L×(B+D)	BREADTH OF		PROPORTION OF LENGTH OF VESSEL TO DEPTH TO UPPER DECK. 13½ THICKNESSES FOR ½ LENGTH AMIDSHIPS.													THICKNESSES AT ENDS.	
					UPPER DECK.												
					FLUSH DECK VESSELS.								Increase to Stringer Plate, Deck Plating and Tie Plates for Vessels having 100 per Cent. Superstructures.	Deck Plating within Line of Deck Openings.	Minimum for Unsheathed Deck Plating abreast Deck Openings.		
					When One Deck is Fitted.		When Two Decks are Fitted.				When Three Decks are Fitted.						
							2nd Deck of Stringers and Tie Plates.		2nd Deck of Steel.		2nd and 3rd Decks of Steel.						
	Sheerstrake and Strake below.	Stringer Plate.	Sheerstrake.	Strake below Sheerstrake.	Stringer Plate	Tie Plates and Deck Plating.	Stringer Plate.	Tie Plates and Deck Plating.	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.				Stringer Plates at Ends of Upper Deck, also Thickness of Tie Plates at Ends.	Thickness of Upper Deck Plating at Ends.
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
140	1015		8,5	8	510 × 7,5	255 × 7,5							0,5			305 × 6	
185	1015		9	8	560 × 8	255 × 8							0,5			305 × 6	
230	1040		9	8	610 × 8	255 × 8							0,5			330 × 6	
280	1040		9,5	8,5	660 × 8,5	255 × 8,5							0,5			355 × 6	
325	1040		9,5	8,5	660 × 8,5	255 × 8,5							0,5			380 × 6,5	
370	1065		10	9	710 × 9	255 × 9							0,5			405 × 6,5	
420	1065		10	9	760 × 9	255 × 9							0,5			430 × 7	
465	1090		10,5	9,5	815 × 9,5	280 × 9,5							0,5			455 × 7	
535	1090		10,5	9,5	865 × 9,5	305 × 9,5							0,5			510 × 7,5	
605	1120		11	10	915 × 10	330 × 10							1			535 × 8	
675	1120		11,5	10,5	965 × 10	355 × 10							1,5			585 × 8	
745	1145		12	11	1015 × 10,5	380 × 10,5							2			635 × 8,5	
835	1145		12,5	11	1065 × 11	405 × 11							2,5			660 × 8,5	
930	1145	1145	13	11,5	1120 × 11,5	455 × 11,5							3,5	7,5	8	685 × 8,5	7,5
1020	1170	1145	13,5	12	1120 × 12	510 × 12							4	7,5	8	710 × 8,5	7,5
1115	1170	1145	14	12,5	1170 × 12	560 × 12	1065 × 11	455 × 11	10				4,5	7,5	8	735 × 8,5	7,5
1210	1170	1145	14,5	12,5	1220 × 12	610 × 12	1120 × 11	535 × 11	10				4,5	7,5	8	760 × 8,5	7,5
1300	1170	1145	15	13	1270 × 12,5	685 × 12,5	1170 × 11,5	635 × 11,5	10,5				5	7,5	8	785 × 8,5	7,5
1395	1195	1145	15,5	13,5	1395 × 12,5	865 × 12,5	1270 × 12	760 × 12	10,5				5	8	8	815 × 9	7,5
1485	1195	1145	16,5	14	11,5	7,5	10,5	7,5	10,5				3,5	8	8	840 × 9	7,5
1580	1195	1145	17	14,5	13	7,5	11,5	7,5	11				3,5	8,5	8,5	840 × 9	7,5
1670	1220	1145	17,5	14,5	13,5	8	12,5	7,5	11	7,5	10,5		3,5	8,5	8,5	865 × 9	7,5
1765	1220	1170	18	15	14,5	8,5	14	7,5	11,5	7,5	11		3,5	8,5	8,5	865 × 9,5	7,5
1860	1220	1170	18,5	15	15,5	9	15	8	13	7,5	12,5	7,5	4	9	9	890 × 9,5	7,5
1950	1220	1195	19	15,5	16	9,5	15,5	8,5	14	7,5	13,5	7,5	4	9	9	890 × 9,5	7,5
2045	1220	1220	19,5	16,5	16,5	10,5	16,5	9	15,5	7,5	15	7,5	4	9,5	9,5	890 × 9,5	7,5
2135	1245	1245	20	17	17	11,5	17	10	16,5	8	15,5	8	4	9,5	9,5	915 × 9,5	7,5
2230	1245	1270	20,5	17,5	17,5	12	17,5	10,5	17	9	17	8,5	4,5	9,5	9,5	915 × 9,5	8

The thicknesses of the Sheerstrake and of the Strake below the Sheerstrake at the ends of the vessel may be the same as the thickness of the side plating at the ends of the vessel.

TOPSIDE SCANTLINGS. TABLE 20

FULL SCANTLING VESSELS. (CONCLUDED.)

SECOND LONGITUDINAL NUMERAL. $L \times (B+D)$	BREADTH OF		PROPORTION OF LENGTH OF VESSEL TO DEPTH TO UPPER DECK. $13\frac{1}{2}$													THICKNESSES AT ENDS.	
			THICKNESSES FOR $\frac{1}{2}$ LENGTH AMIDSHIPS.														
					UPPER DECK.												
					FLUSH DECK VESSELS.												
					When One Deck is Fitted.		When Two Decks are Fitted.				When Three Decks are Fitted.		Increase to Stringer Plate, Deck Plating and Tie Plates for Vessels having 100 per Cent. Superstructures.	Deck Plating within Line of Deck Openings.	Minimum for Unsheathed Deck Plating abreast Deck Openings.	Stringer Plates at Ends of Upper Deck, also Thickness of Tie Plates at Ends.	Thickness of Upper Deck Plating at Ends.
							2nd Deck of Stringers and Tie Plates.		2nd Deck of Steel.		2nd and 3rd Decks of Steel.						
	Sheerstrake and Strake below.	Stringer Plate.	Sheerstrake.	Strake below Sheerstrake.	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.					
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm	mm.
2370	1245	1295	21	17,5	18	13	18	12	17,5	9,5	17,5	9	5	9,5	9,5	915 × 10	8
2510	1245	1320	21,5	18	18,5	14	18,5	13	18,5	10	18,5	9,5	5	10	10	940 × 10	8
2650	1270	1345	22	18,5	19	15	19	14,5	18,5	11	18,5	10,5	5	10	10	940 × 10	8
2785	1270	1370	22,5	19	19,5	17	19,5	15,5	19,5	11,5	19,5	11	5,5	10	10	940 × 10	8,5
2925	1270	1395	23	19,5	20	18			20	12,5	20	11,5	5,5	10,5	10,5	965 × 10	8,5
3060	1270	1420	23,5	19,5	20,5	19			20,5	13,5	20,5	12,5	5,5	10,5	10,5	965 × 10,5	8,5
3200	1270	1450	24	20	21	20			21	14,5	21	13,5	5,5	10,5	10,5	965 × 10,5	8,5
3340	1270	1475	24,5	20,5	21,5	21			21,5	15,5	21,5	14,5	6	10,5	10,5	990 × 10,5	9
3480	1295	1500	25	21					21,5	16,5	21,5	15,5	6	11	11	990 × 10,5	9
3620	1295	1525	25,5	21,5					22,5	17,5	22,5	16,5	6	11	11	990 × 10,5	9
3760	1295	1550	25,5	21,5					22,5	18,5	22,5	17,5	6	11	11	1015 × 11	9
3900	1295	1575	26	22					23	19	23	18	6	11,5	11,5	1015 × 11	9
4040	1295	1600	26,5	22,5					23,5	20	23,5	18,5	6	11,5	11,5	1015 × 11	9
4180	1320	1625	27	23					24	21	24	19,5	6	11,5	11,5	1040 × 11	9
4320	1320	1650	27,5	23,5					24,5	21,5	24,5	20	6	11,5	11,5	1040 × 11	9
4460	1320	1675	28	23,5					25	22	25	21	6	12	12	1040 × 11	9
4640	1320	1725	28,5	24					25,5	23	25,5	21,5	6	12	12	1065 × 11,5	9
4830	1345	1755	29	24					26	24	26	22	6	12	12	1065 × 11,5	9
5020	1345	1780	29,5	24,5					26,5	25	26,5	22,5	6	12	12	1065 × 11,5	9,5
5200	1345	1830	30	25					27	26	27	24	6	12	12	1090 × 11,5	9,5
5390	1370	1880	30,5	25,5					27,5	27,5	27,5	25	6	12,5	12,5	1090 × 11,5	9,5
5570	1370	1930	31	26					28,5	28,5	28	26	6	12,5	12,5	1090 × 11,5	9,5
5760																1120 × 11,5	9,5
5950																1120 × 12	9,5
6130																1120 × 12	9,5
6320																1145 × 12	9,5
6500																1145 × 12	9,5

The thicknesses of the Sheerstrake and of the Strake below the Sheerstrake at the ends of the vessel may be the same as the thickness of the side plating at the ends of the vessel.

TOPSIDE SCANTLINGS.

COMPLETE SUPERSTRUCTURE VESSELS.

TABLE 21

(SEE CONTINUATION.)

SECOND LONGITUDINAL NUMERAL. L × (B + D)	BREADTH OF		PROPORTION OF LENGTH OF VESSEL TO DEPTH TO UPPER DECK. 10									
			THICKNESSES FOR ½ LENGTH AMIDSHIPS.									
					UPPER DECK.							
					When Two Decks are Fitted.				When Three Steel Decks are Fitted.			
					2nd Deck of Stringers and Tie Plates.		2nd Deck of Steel.		2nd and 3rd Decks of Steel.		Deck Plating within Line of Deck Openings.	Minimum for Unsheathed Deck Plating abreast Deck Openings.
	Sheerstrake and Strake below.	Stringer Plate.	Sheerstrake.	Strake below Sheerstrake.	Stringer Plate.	Tie Plates and Deck Plating.	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.		
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
1115	1170	1145	10	10	1065 × 10,5	305 × 10,5	8,5				7,5	8
1210	1170	1145	10,5	10,5	1065 × 10,5	305 × 10,5	9				7,5	8
1300	1170	1145	11	11	1090 × 10,5	305 × 10,5	9,5				7,5	8
1390	1195	1145	11,5	11,5	1090 × 10,5	330 × 10,5	10				7,5	8
1485	1195	1145	11,5	11,5	1120 × 10,5	355 × 10,5	10				7,5	8,5
1580	1195	1145	12	12	1145 × 11	380 × 11	10				7,5	8,5
1670	1220	1145	12	12	1170 × 11	455 × 11	10,5		9,5		7,5	8,5
1765	1220	1170	12,5	12,5	1170 × 11,5	635 × 11,5	10,5		10		7,5	8,5
1860	1220	1170	12,5	12,5	1270 × 12	685 × 12	10,5		10		7,5	9
1950	1220	1195	13	13	1345 × 12	815 × 12	11		10,5		7,5	9
2045	1220	1220	13	13	1395 × 12,5	890 × 12,5	11		10,5		8	9
2135	1245	1245	13,5	13,5	1450 × 12,5	1015 × 12,5	11		10,5		8	9,5
2230	1245	1270	14	14	1525 × 12,5	1145 × 12,5	11		11		8	9,5
2370	1245	1295	14,5	14,5	12	8	11,5		11		8	9,5
2510	1245	1320	14,5	14,5	12,5	8,5	11,5		11,5		8,5	10
2650	1270	1345	15	15	13	8,5	12		11,5		8,5	10
2785	1270	1370	15,5	15	13,5	10	12		12		8,5	10,5
2925	1270	1395	15,5	15	14	11	12,5	9	12,5		9	10,5
3060	1270	1420	16	15,5	14,5	11,5	12,5	9,5	12,5		9	10,5
3200	1270	1450	16	15,5	14,5	12,5	13	9,5	13		9	11
3340	1270	1475	16,5	15,5	14,5	13,5	13,5	10	13	9	9	11
3480	1295	1500	17	16			14	10,5	13	9,5	9,5	11
3620	1295	1525	17	16,5			14	11	13,5	9,5	9,5	11
3760	1295	1550	17,5	17			14,5	11,5	14	10	10	11,5

TOPSIDE SCANTLINGS.

COMPLETE SUPERSTRUCTURE VESSELS.

TABLE 21

(SEE CONTINUATION.)

SECOND LONGITUDINAL NUMERAL. L × (B + D)	BREADTH OF		PROPORTION OF LENGTH OF VESSEL TO DEPTH TO UPPER DECK. 10 — THICKNESSES FOR ½ LENGTH AMIDSHIPS.									
					UPPER DECK.							
					When Two Decks are Fitted.				When Three Steel Decks are Fitted.			
					2nd Deck of Stringers and Tie Plates.		2nd Deck of Steel.		2nd and 3rd Decks of Steel.		Deck Plating within Line of Deck Openings.	Minimum for Unsheathed Deck Plating abreast Deck Openings.
	Sheer-strake and Strake below.	Stringer Plate.	Sheer-strake.	Strake below Sheer-strake.	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.		
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
3900	1295	1575	17,5	17			15	12	14,5	10	10	11,5
4040	1295	1600	18	17,5			15,5	13	15	10,5	10,5	11,5
4180	1320	1625	18,5	18			16,5	13,5	15,5	11	10,5	12
4320	1320	1650	19	18,5			17	14	16,5	11,5	10,5	12
4460	1320	1675	19	18,5			17,5	14,5	17	12,5	10,5	12
4640	1320	1725	19,5	19			18	15,5	17,5	13,5	11	12
4830	1345	1755	19,5	19			18	17	17,5	14	11	12
5020	1345	1780	20	19,5			18,5	18	18	15	11	12
5200	1345	1830	20	19,5			19	19	18	15,5	11,5	12
5390	1370	1880	20,5	20			20	20	18,5	17	11,5	12
5570	1370	1930	20,5	20			21	21	19	18	11,5	12
5760	1370	1955	21	20,5			21,5	21,5	19,5	19	12	12
5950	1395	2005	21	20,5			22	22	20	19,5	12	12
6130	1395	2030	21	20,5			23	23	20,5	20,5	12	12
6320	1420	2055	21	20,5			23,5	23,5	21,5	21,5	12	12
6500	1420	2085	21,5	21			24,5	24,5	22	22	12,5	12,5
6690	1420	2135	22	21,5			25,5	25,5	23	23	12,5	12,5
6920	1420	2185	22	21,5			26,5	26,5	23,5	23,5	12,5	12,5
7150	1450	2235	22,5	22			27,5	27,5	24,5	24,5	13	13
7390	1450	2285	23	22,5			28,5	28,5	25,5	25,5	13	13
7620	1475	2335	23,5	23			29,5	29,5	26,5	26,5	13	13
7850	1500	2390	24	23,5			30,5	30,5	27,5	27,5	13,5	13,5
8080	1525	2440	24	23,5					28,5	28,5	13,5	13,5

TOPSIDE SCANTLINGS.

COMPLETE SUPERSTRUCTURE VESSELS.

TABLE 21

(SEE CONTINUATION.)

SECOND LONGITUDINAL NUMERAL. $L \times (B + D)$	BREADTH OF		PROPORTION OF LENGTH OF VESSEL TO DEPTH TO UPPER DECK. 11									
			THICKNESSES FOR $\frac{1}{2}$ LENGTH AMIDSHIPS.									
					UPPER DECK.							
					When Two Decks are Fitted.				When Three Steel Decks are Fitted.		Deck Plating within Line of Deck Openings.	Minimum for Unsheathed Deck Plating abreast Deck Openings.
					2nd Deck of Stringers and Tie Plates.		2nd Deck of Steel.		2nd and 3rd Decks of Steel.			
	Sheer-strake and Strake below.	Stringer Plate.	Sheer-strake.	Strake below Sheer-strake.	Stringer Plate.	Tie Plates and Deck Plating.	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.		
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
1115	1170	1145	10,5	10,5	1065 × 10,5	305 × 10,5	9				7,5	8
1210	1170	1145	11	11	1065 × 10,5	305 × 10,5	9				7,5	8
1300	1170	1145	11,5	11,5	1090 × 10,5	305 × 10,5	9,5				7,5	8
1390	1195	1145	11,5	11,5	1090 × 10,5	330 × 10,5	9,5				7,5	8
1485	1195	1145	12	12	1120 × 11	355 × 11	10				7,5	8
1580	1195	1145	12	12	1145 × 11	380 × 11	10				7,5	8,5
1670	1220	1145	12,5	12,5	1170 × 11,5	455 × 11,5	10		9,5		7,5	8,5
1765	1220	1170	12,5	12,5	1195 × 11,5	635 × 11,5	10,5		10		7,5	8,5
1860	1220	1170	13	12,5	1295 × 12	685 × 12	10,5		10		7,5	8,5
1950	1220	1195	13	13	1370 × 12	815 × 12	11		10,5		7,5	9
2045	1220	1220	13,5	13	1450 × 12,5	890 × 12,5	11		10,5		8	9
2135	1245	1245	14	13,5	1525 × 12,5	1015 × 12,5	11,5		11		8	9
2230	1245	1270	14,5	14	12	8	12		11		8	9,5
2370	1245	1295	15	14,5	12,5	8,5	12,5		11,5		8,5	9,5
2510	1245	1320	15	14,5	12,5	9	12,5		12		8,5	9,5
2650	1270	1345	15,5	15	13	9,5	13		12		8,5	10
2785	1270	1370	15,5	15	13,5	10	13	9	12,5		9	10
2925	1270	1395	16	15	14	11,5	13	9,5	13		9	10,5
3060	1270	1420	16,5	15,5	14,5	12,5	13,5	10,5	13,5		9	10,5
3200	1270	1450	17	15,5	15	13	14	11	14		9,5	10,5
3340	1270	1475	17	15,5	15,5	14	14	12	14	9,5	9,5	11
3480	1295	1500	17,5	16			14,5	12,5	14,5	10,5	9,5	11
3620	1295	1525	17,5	16,5			15	13,5	15	11	10	11
3760	1295	1550	18	17			15,5	14	15,5	11,5	10	11

TOPSIDE SCANTLINGS.

COMPLETE SUPERSTRUCTURE VESSELS.

TABLE 21

(SEE CONTINUATION.)

SECOND LONGITUDINAL NUMERAL. $L \times (B + D)$	BREADTH OF		PROPORTION OF LENGTH OF VESSEL TO DEPTH TO UPPER DECK. 11									
			THICKNESSES FOR $\frac{1}{2}$ LENGTH AMIDSHIPS.									
					UPPER DECK.							
					When Two Decks are Fitted.				When Three Steel Decks are Fitted.			
					2nd Deck of Stringers and Tie Plates.		2nd Deck of Steel.		2nd and 3rd Decks of Steel.			
	Sheer-strake and Strake below.	Stringer Plate.	Sheer-strake.	Strake below Sheer-strake.	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.	Deck Plating within Line of Deck Openings.	Minimum for Unsheathed Deck Plating abreast Deck Openings.
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
3900	1295	1575	18	17			16	14,5	15,5	12,5	10	11,5
4040	1295	1600	18,5	17,5			16,5	15,5	16,5	13	10,5	11,5
4180	1320	1625	19	18			17	16	17	13,5	10,5	11,5
4320	1320	1650	19,5	18,5			18	16,5	17	14,5	10,5	12
4460	1320	1675	20	19			18,5	17	17,5	15,5	10,5	12
4640	1320	1725	20,5	19,5			19	18	18	17	11	12
4830	1345	1755	20,5	19,5			19,5	19	18,5	18	11	12
5020	1345	1780	21	20			20	20	19,5	19	11	12
5200	1345	1830	21	20			21	21	20	19,5	11,5	12
5390	1370	1880	21,5	20,5			21,5	21,5	20,5	20,5	11,5	12
5570	1370	1930	21,5	20,5			22,5	22,5	21	21	11,5	12
5760	1370	1955	22	21			23,5	23,5	22	22	12	12
5950	1395	2005	22	21			24	24	22,5	22,5	12	12
6130	1395	2030	22,5	21,5			25	25	23,5	23,5	12	12
6320	1420	2055	22,5	21,5			26	26	24,5	24,5	12	12
6500	1420	2085	23	22			27	27	25	25	12,5	12,5
6690	1420	2135	23,5	22,5			28	28	25,5	25,5	12,5	12,5
6920	1420	2185	23,5	22,5			29	29	26,5	26,5	12,5	12,5
7150	1450	2235	24	22,5			30	30	27,5	27,5	13	13
7390	1450	2285	24,5	23					28,5	28,5	13	13
7620	1475	2335	25	23,5					29,5	29,5	13	13
7850	1500	2390	25,5	24					30,5	30,5	13,5	13,5
8080	1525	2440	26	24,5								

TOPSIDE SCANTLINGS.

COMPLETE SUPERSTRUCTURE VESSELS.

TABLE 2

(SEE CONTINUATION.)

PROPORTION OF LENGTH OF VESSEL TO DEPTH TO UPPER DECK.

12

SECOND LONGITUDINAL NUMERAL. L × (B + D)	BREADTH OF		THICKNESSES FOR ½ LENGTH AMIDSHIPS.									
					UPPER DECK.							
					When Two Decks are Fitted.				When Three Steel Decks are Fitted.			
					2nd Deck of Stringers and Tie Plates.		2nd Deck of Steel.		2nd and 3rd Decks of Steel.		Deck Plating within Line of Deck Openings	Minimum for Unsheathed Deck Plating abreast Deck Openings.
	Sheer-strake and Strake below.	Stringer Plate.	Sheer-strake.	Strake below Sheer-strake.	Stringer Plate.	Tie Plates and Deck Plating.	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.		
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
1115	1170	1145	11	11	1065 × 10,5	305 × 10,5	9,5				7,5	8
1210	1170	1145	11,5	11	1065 × 10,5	305 × 10,5	9,5				7,5	8
1300	1170	1145	11,5	11,5	1090 × 10,5	305 × 10,5	9,5				7,5	8
1390	1195	1145	12	11,5	1090 × 11	330 × 11	9,5				7,5	8
1485	1195	1145	12,5	12	1120 × 11,5	355 × 11,5	10				7,5	8
1580	1195	1145	12,5	12	1145 × 11,5	380 × 11,5	10				7,5	8,5
1670	1220	1145	13	12,5	1170 × 12	455 × 12	10		9,5		7,5	8,5
1765	1220	1170	13,5	13	1220 × 12,5	635 × 12,5	10,5		10		7,5	8,5
1860	1220	1170	14	13	1295 × 12,5	710 × 12,5	10,5		10		7,5	8,5
1950	1220	1195	14	13,5	1395 × 12,5	815 × 12,5	11		10,5		7,5	9
2045	1220	1220	14,5	13,5	1525 × 12,5	890 × 12,5	11		10,5		8	9
2135	1245	1245	14,5	14	11,5	8	11,5		11		8	9
2230	1245	1270	15	14,5	12	8,5	12		11		8,5	9,5
2370	1245	1295	15,5	14,5	13	9	12,5		11,5		8,5	9,5
2510	1245	1320	15,5	14,5	14	10	12,5		12		9	9,5
2650	1270	1345	16	15	14	11	13,5		12,5		9	10
2785	1270	1370	16,5	15	14,5	12	14,5	9	13,5	9	9	10
2925	1270	1395	17	15,5	14,5	13	14,5	10	14	9,5	9,5	10,5
3060	1270	1420	17	16	15	14	15	11	14,5	10	9,5	10,5
3200	1270	1450	17,5	16,5	16	15,5	15	11,5	15	10,5	9,5	10,5
3340	1270	1475	17,5	17	17	17	15,5	12,5	15,5	11,5	9,5	11
3480	1295	1500	18	17			15,5	13,5	16	12,5	10	11
3620	1295	1525	18	17			16,5	14,5	16,5	13	10	11
3760	1295	1550	18,5	17,5			17	15,5	17	14	10,5	11

TOPSIDE SCANTLINGS.

COMPLETE SUPERSTRUCTURE VESSELS.

TABLE 21

(SEE CONTINUATION.)

SECOND LONGITUDINAL NUMERAL. L × (B + D)	BREADTH OF		PROPORTION OF LENGTH OF VESSEL TO DEPTH TO UPPER DECK. 12									
			THICKNESSES FOR ½ LENGTH AMIDSHIPS.									
					UPPER DECK.							
					When Two Decks are Fitted.				When Three Steel Decks are Fitted.			
					2nd Deck of Stringers and Tie Plates.		2nd Deck of Steel.		2nd and 3rd Decks of Steel.		Deck Plating within Line of Deck Openings	Minimum for Unsheathed Deck Plating abreast Deck Openings.
	Sheer-strake and Strake below.	Stringer Plate.	Sheer-strake.	Strake below Sheer-strake.	Stringer Plate.	Deck Plating.	Stringer Plate	Deck Plating.	Stringer Plate.	Deck Plating.		
	mm.	mm.	mm.	mm.	mm.	mm	mm.	mm.	mm.	mm.	mm.	mm.
3900	1295	1575	18,5	17,5			17,5	17	17,5	15	10,5	11,5
4040	1295	1600	19	18			18	18	18	15,5	10,5	11,5
4180	1320	1625	19,5	18,5			18,5	18,5	18,5	16,5	10,5	11,5
4320	1320	1650	20	19			19,5	19,5	19	17,5	11	12
4460	1320	1675	20,5	19,5			20	20	19,5	18	11	12
4640	1320	1725	21	20			21	21	20	19,5	11	12
4830	1345	1755	21,5	20			21,5	21,5	20	20	11	12
5020	1345	1780	22	20,5			22,5	22,5	21	21	11,5	12
5200	1345	1830	22,5	21			23	23	21,5	21,5	11,5	12
5390	1370	1880	23	21			24	24	22,5	22,5	11,5	12
5570	1370	1930	23,5	21,5			25	25	23,5	23,5	12	12
5760	1370	1955	23,5	21,5			26,5	26,5	24,5	24,5	12	12
5950	1395	2005	24	22			27,5	27,5	25,5	25,5	12	12
6130	1395	2030	24,5	22,5			28,5	28,5	26,5	26,5	12	12
6320	1420	2055	25	23			29,5	29,5	27	27	12	12
6500	1420	2085	25	23			30,5	30,5	28	28	12,5	12,5
6690	1420	2135	25,5	23,5					28,5	28,5	12,5	12,5
6920	1420	2185	25,5	23,5					29,5	29,5	12,5	12,5
7150	1450	2235	26	24					30,5	30,5	13	13
7390	1450	2285	26,5	24,5								
7620	1475	2335	27	24,5								
7850	1500	2390	27,5	25								
8080	1525	2440	28,5	25,5								

TOPSIDE SCANTLINGS.

COMPLETE SUPERSTRUCTURE VESSELS.

TABLE 21

(SEE CONTINUATION.)

SECOND LONGITUDINAL NUMERAL. $L \times (B + D)$	BREADTH OF		PROPORTION OF LENGTH OF VESSEL TO DEPTH TO UPPER DECK. 13									
			THICKNESSES FOR $\frac{1}{2}$ LENGTH AMIDSHIPS.									
					UPPER DECK.							
					When Two Decks are Fitted.				When Three Steel Decks are Fitted.		Deck Plating within Line of Deck Openings.	Minimum for Unsheathed Deck Plating abreast Deck Openings.
					2nd Deck of Stringers and Tie Plates.		2nd Deck of Steel.		2nd and 3rd Decks of Steel.			
	Sheer-strake and Strake below.	Stringer Plate.	Sheer-strake.	Strake below Sheer-strake.	Stringer Plate.	Tie Plates and Deck Plating.	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.		
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
1115	1170	1145	11,5	11	1065 × 11	305 × 11	10				7,5	8
1210	1170	1145	12	11	1090 × 11	305 × 11	10				7,5	8
1300	1170	1145	12,5	11,5	1090 × 11,5	305 × 11,5	10				7,5	8
1390	1195	1145	12,5	11,5	1120 × 11,5	330 × 11,5	10,5				7,5	8
1485	1195	1145	13	12	1120 × 12	355 × 12	10,5				7,5	8
1580	1195	1145	13	12	1170 × 12	380 × 12	10,5				7,5	8
1670	1220	1145	13,5	12,5	1170 × 12,5	455 × 12,5	10,5				7,5	8,5
1765	1220	1170	14	13	1270 × 12,5	635 × 12,5	11		10		7,5	8,5
1860	1220	1170	14,5	13	1320 × 12,5	735 × 12,5	11		10		7,5	8,5
1950	1220	1195	14,5	13,5	1395 × 12,5	840 × 12,5	11,5		10,5		7,5	8,5
2045	1220	1220	15	13,5	11	8	11,5		10,5		8	9
2135	1245	1245	15	14	12	8	12		11		8	9
2230	1245	1270	15,5	14,5	12,5	8,5	12,5		11,5		8,5	9
2370	1245	1295	16,5	14,5	13	9,5	13		11,5		8,5	9,5
2510	1245	1320	17	15	14	10,5	13,5		12		9	9,5
2650	1270	1345	17,5	15,5	14	11,5	13,5	9	13		9	9,5
2785	1270	1370	17,5	15,5	14,5	12	14,5	9,5	14	9	9	10
2925	1270	1395	18	16	14,5	13,5	14,5	10,5	14	10	9,5	10
3060	1270	1420	18	16,5	15	15	15	11,5	14,5	11	9,5	10,5
3200	1270	1450	18,5	17	16,5	16,5	15,5	12	15	11,5	9,5	10,5
3340	1270	1475	18,5	17,5	17,5	17,5	16,5	12,5	16	12	10	10,5
3480	1295	1500	19	17,5			17	13,5	17	13	10	11
3620	1295	1525	19,5	18			17,5	14,5	17,5	13,5	10	11
3760	1295	1550	20	18			18	15,5	18	14,5	10,5	11

TOPSIDE SCANTLINGS.

COMPLETE SUPERSTRUCTURE VESSELS.

TABLE 21

(SEE CONTINUATION.)

SECOND LONGITUDINAL NUMERAL. L × (B + D)	BREADTH OF		PROPORTION OF LENGTH OF VESSEL TO DEPTH TO UPPER DECK. 13									
			THICKNESSES FOR ½ LENGTH AMIDSHIPS.									
					UPPER DECK.							
					When Two Decks are Fitted.				When Three Steel Decks are Fitted.			
					2nd Deck of Stringers and Tie Plates.		2nd Deck of Steel.		2nd and 3rd Decks of Steel.		Deck Plating within Line of Deck Openings.	Minimum for Unsheathed Deck Plating abreast Deck Openings.
	Sheer-strake and Strake below.	Stringer Plate.	Sheer-strake.	Strake below Sheer-strake.	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.		
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
3900	1295	1575	20,5	18,5			18,5	17	18,5	15	10,5	11
4040	1295	1600	21	19			19	18	19	16,5	10,5	11,5
4180	1320	1625	21,5	19,5			19,5	18,5	19,5	17,5	10,5	11,5
4320	1320	1650	22	20			20	19,5	20	18	11	11,5
4460	1320	1675	22,5	20			21	20	21	18,5	11	12
4640	1320	1725	23	20,5			21,5	21,5	21,5	19,5	11	12
4830	1345	1755	23,5	21			22,5	22,5	22	20,5	11	12
5020	1345	1780	24	21,5			23,5	23,5	22	22	11,5	12
5200	1345	1830	24,5	22			24	24	22,5	22,5	11,5	12
5390	1370	1880	25	22			25	25	23,5	23,5	11,5	12
5570	1370	1930	25,5	22,5			26	26	24,5	24,5	12	12
5760	1370	1955	26	22,5			27	27	25,5	25,5	12	12
5950	1395	2005	26,5	23			28	28	26,5	26,5	12	12
6130	1395	2030	27	23,5			29	29	27,5	27,5	12,5	12,5
6320	1420	2055	27,5	24			30	30	28,5	28,5	12,5	12,5
6500	1420	2085	28	24,5			31	31	29,5	29,5	12,5	12,5
6690	1420	2135	28,5	25					30,5	30,5	12,5	12,5
6920	1420	2185	29	25,5								
7150	1450	2235	29,5	25,5								
7390	1450	2285	30	26								
7620	1475	2335	30,5	26,5								
7850												
8080												

TOPSIDE SCANTLINGS.

COMPLETE SUPERSTRUCTURE VESSELS.

TABLE 21

(SEE CONTINUATION.)

SECOND LONGITUDINAL NUMERAL.	BREADTH OF		PROPORTION OF LENGTH OF VESSEL TO DEPTH TO UPPER DECK. $13\frac{1}{2}$										THICKNESSES AT ENDS.	
			THICKNESSES FOR $\frac{1}{2}$ LENGTH AMIDSHIPS.											
					UPPER DECK.									
					When Two Decks are Fitted.				When Three Steel Decks are Fitted.					
					2nd Deck of Stringers and Tie Plates.		2nd Deck of Steel.		2nd and 3rd Decks of Steel.					
$L \times (B+D)$	Sheerstrake and Strake below.	Stringer Plate.	Sheerstrake.	Strake below Sheerstrake.	Stringer Plate.	Tie Plates and Deck Plating.	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.	Deck Plating within Line of Deck Openings	Minimum for Unsheathed Deck Plating abreast Deck Openings	Stringer Plates at Ends of Upper Deck; also thickness of Tie Plates at Ends.	Thickness of Upper Deck Plating at Ends.
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
1115	1170	1145	11,5	11	1065 × 11	305 × 11	10				7,5	8	735 × 8,5	7,5
1210	1170	1145	12	11	1090 × 11	305 × 11	10				7,5	8	760 × 8,5	7,5
1300	1170	1145	12,5	11,5	1120 × 11,5	305 × 11,5	10				7,5	8	785 × 8,5	7,5
1390	1195	1145	12,5	11,5	1120 × 11,5	330 × 11,5	10,5				7,5	8	815 × 9	7,5
1485	1195	1145	13	12	1245 × 12	355 × 12	10,5				7,5	8	840 × 9	7,5
1580	1195	1145	13	12	1170 × 12,5	380 × 12,5	10,5				7,5	8	840 × 9	7,5
1670	1220	1145	13,5	12,5	1195 × 12,5	455 × 12,5	10,5				7,5	8,5	865 × 9	7,5
1765	1220	1170	14	13	1270 × 12,5	635 × 12,5	11		10		7,5	8,5	865 × 9,5	7,5
1860	1220	1170	14,5	13	1320 × 12,5	735 × 12,5	11		10		7,5	8,5	890 × 9,5	7,5
1950	1220	1195	14,5	13,5	1395 × 12,5	840 × 12,5	11,5		10,5		7,5	8,5	890 × 9,5	7,5
2045	1220	1220	15	13,5	11	8	11,5		10,5		8	9	890 × 9,5	7,5
2135	1245	1245	15	14	12	8	12		11		8	9	915 × 9,5	7,5
2230	1245	1270	15,5	14,5	12,5	8,5	12,5		11,5		8,5	9	915 × 9,5	8
2370	1245	1295	16,5	14,5	13,5	8,5	13		11,5		8,5	9,5	915 × 10	8
2510	1245	1320	17	15	14	10,5	13,5		12		9	9,5	940 × 10	8
2650	1270	1345	17,5	15,5	14	11,5	13,5	9	13		9	9,5	940 × 10	8
2785	1270	1370	17,5	15,5	14,5	12	14,5	9,5	14	9	9	10	940 × 10	8,5
2925	1270	1395	18	16	14,5	13,5	14,5	10,5	14,5	10	9,5	10	965 × 10	8,5
3060	1270	1420	18	16,5	15	15	15	11,5	15	11	9,5	10,5	965 × 10,5	8,5
3200	1270	1450	18,5	17	16,5	16,5	16	12	15,5	11,5	9,5	10,5	965 × 10,5	8,5
3340	1270	1475	19	17,5	17,5	17,5	17	12,5	17	12	10	10,5	990 × 10,5	9
3480	1295	1500	19,5	17,5			17,5	13,5	17,5	13	10	11	990 × 10,5	9
3620	1295	1525	20	18			18	14,5	18	13,5	10	11	990 × 10,5	9
3760	1295	1550	20,5	18			18,5	15,5	18,5	14,5	10,5	11	1015 × 11	9

The Thicknesses of the Sheerstrake and of the Strake below the Sheerstrake at the ends of the vessel may be the same as the thickness of the side plating at the ends of the vessel.

TOPSIDE SCANTLINGS.

COMPLETE SUPERSTRUCTURE VESSELS.

TABLE 21 (CONCLUDED.)

SECOND LONGITUDINAL NUMERAL. $L \times (B+D)$	BREADTH OF		PROPORTION OF LENGTH OF VESSEL TO DEPTH TO UPPER DECK. $13\frac{1}{2}$										THICKNESSES AT ENDS.	
			THICKNESSES FOR $\frac{1}{2}$ LENGTH AMIDSHIPS.											
					UPPER DECK.									
					When Two Decks are Fitted.				When Three Steel Decks are Fitted.					
					2nd Deck of Stringers and Tie Plates.		2nd Deck of Steel.		2nd and 3rd Decks of Steel.					
	Sheerstrake and Strake below.	Stringer Plate.	Sheerstrake.	Strake below Sheerstrake.	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.	Deck Plating within Line of Deck Openings	Minimum for Unsheathed Deck Plating abreast Deck Openings	Stringer Plates at Ends of Upper Deck also thickness of Tie Plates at Ends.	Thickness of Upper Deck Plating at Ends.
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
3900	1295	1575	21	18,5			19	17	19	15	10,5	11	1015 × 11	9
4040	1295	1600	21,5	19			19,5	18	19,5	16,5	10,5	11,5	1015 × 11	9
4180	1320	1625	22	19,5			20	18,5	20	17,5	10,5	11,5	1040 × 11	9
4320	1320	1650	22,5	20			20,5	19,5	20,5	18	11	11,5	1040 × 11	9
4460	1320	1675	23	20			21,5	20	21,5	18,5	11	12	1040 × 11	9
4640	1320	1725	23,5	20,5			22	21,5	21,5	20	11	12	1065 × 11,5	9
4830	1345	1755	24	21			22,5	22,5	22	21	11	12	1065 × 11,5	9
5020	1345	1780	24,5	21,5			23,5	23,5	22,5	22	11,5	12	1065 × 11,5	9,5
5200	1345	1830	25	22			24,5	24,5	23	23	11,5	12	1090 × 11,5	9,5
5390	1370	1880	25,5	22,5			25,5	25,5	24	24	11,5	12	1090 × 11,5	9,5
5570	1370	1930	26	23			26,5	26,5	25	25	12	12	1090 × 11,5	9,5
5760	1370	1955	27	23			27,5	27,5	26	26	12	12	1120 × 11,5	9,5
5950	1395	2005	27,5	23,5			28,5	28,5	27	27	12	12	1120 × 12	9,5
6130	1395	2030	28	24			29,5	29,5	28	28	12,5	12,5	1120 × 12	9,5
6320	1420	2055	28,5	24,5			30,5	30,5	29	29	12,5	12,5	1145 × 12	9,5
6500	1420	2085	29	25					30	30	12,5	12,5	1145 × 12	9,5
6690	1420	2135	29,5	25,5									1145 × 12,5	10
6920	1420	2185	30	26									1170 × 12,5	10
7150	1450	2235	30,5	26,5									1170 × 12,5	10
7390	1450	2285	31	27									1195 × 12,5	10
7620													1195 × 12,5	10
7850													1220 × 12,5	10
8080													1220 × 12,5	10

The Thicknesses of the Sheerstrake and of the Strake below the Sheerstrake at the ends of the vessel may be the same as the thickness of the side plating at the ends of the vessel.

PARTIAL SUPERSTRUCTURES.
FULL SCANTLING VESSELS.

TABLE 22
(SEE CONTINUATION.)

SECOND LONGITUDINAL NUMERAL L×(B+D)	PERCENTAGE OF LENGTH OF VESSEL COVERED BY SUPERSTRUCTURES. 40	60	80 — THICKNESS OF BRIDGE SIDE PLATING.	BREADTH OF STRINGER PLATE.	PROPORTION OF LENGTH OF VESSEL TO DEPTH TO BRIDGE DECK. 10 — PERCENTAGE OF LENGTH OF VESSEL COVERED BY SUPERSTRUCTURES. 40 — THICKNESS OF "LONG" BRIDGE DECK. When Two Decks are Fitted including Bridge Deck. Stringer Plate.	When Two Decks are Fitted including Bridge Deck. Tie Plates and Deck Plating. *	When Three Steel Decks are Fitted including Bridge Deck. Stringer Plate.	When Three Steel Decks are Fitted including Bridge Deck. Deck Plating.	60 — When Two Decks are Fitted including Bridge Deck. Stringer Plate.	When Two Decks are Fitted including Bridge Deck. Tie Plates and Deck Plating. *	When Three Steel Decks are Fitted including Bridge Deck. Stringer Plate.	When Three Steel Decks are Fitted including Bridge Deck. Deck Plating.	80 — When Two Decks are Fitted including Bridge Deck. Stringer Plate.	When Two Decks are Fitted including Bridge Deck. Tie Plates and Deck Plating. *	When Three Steel Decks are Fitted including Bridge Deck. Stringer Plate.	When Three Steel Decks are Fitted including Bridge Deck. Deck Plating.	Deck Plating within Line of Deck Openings.	Minimum for Unsheathed Deck Plating abreast Deck Openings
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
1115	10	10,5	11	1145	1065 × 9	305 × 9			1065 × 9,5	305 × 9,5			1065 × 10	305 × 10			7,5	8
1210	10	10,5	11	1145	1065 × 9	330 × 9			1065 × 9,5	330 × 9,5			1065 × 10	330 × 10			7,5	8
1300	10	10,5	11	1145	1090 × 9,5	330 × 9,5			1090 × 10	355 × 10			1090 × 10,5	355 × 10,5			7,5	8
1390	10,5	11	11,5	1145	1120 × 9,5	355 × 9,5			1120 × 10	380 × 10			1120 × 10,5	405 × 10,5			7,5	8
1485	10,5	11	11,5	1145	1120 × 10	355 × 10			1145 × 10,5	405 × 10,5			1145 × 11	455 × 11			7,5	8
1580	11	11,5	12	1145	1120 × 10	485 × 10			1170 × 10,5	535 × 10,5			1195 × 11	560 × 11			7,5	8,5
1670	11	11,5	12	1145	1120 × 10,5	560 × 10,5	8,5		1170 × 11	585 × 11	9		1220 × 11,5	610 × 11,5	9,5		7,5	8,5
1765	11,5	12	12,5	1170	1170 × 10,5	735 × 10,5	9		1220 × 11	760 × 11	9,5		1270 × 11,5	785 × 11,5	10		7,5	8,5
1860	11,5	12	12,5	1170	1220 × 10,5	865 × 10,5	9		1270 × 11	915 × 11	9,5		1320 × 11,5	965 × 11,5	10		7,5	8,5
1950	12	12,5	13	1195	1270 × 11	940 × 11	9,5		1320 × 11,5	990 × 11,5	10		1370 × 12	1015 × 12	10,5		7,5	9
2045	12	12,5	13	1220	10	8	9,5	8	10,5	8	10	8	11	8	10,5	8	8	9
2135	12,5	13	13,5	1245	10	8	9,5	8	10,5	8	10	8	11	8	10,5	8	8	9
2230	12,5	13	13,5	1270	10	8	10	8	10,5	8	10,5	8	11	8	11	8	8	9,5
2370	13	13,5	14	1295	10,5	8	10	8	11	8	10,5	8	11,5	8	11	8	8	9,5
2510	13	13,5	14	1320	10,5	8,5	10	8,5	11	8,5	11	8,5	11,5	8,5	11,5	8,5	8,5	10
2650	13,5	14	14,5	1345	11	8,5	10,5	8,5	11	8,5	11	8,5	12	8,5	11,5	8,5	8,5	10
2785	13,5	14	14,5	1370	11	8,5	10,5	8,5	11,5	9	11,5	8,5	12	9	12	8,5	8,5	10
2925	14	14,5	15	1395	11	9	10,5	9	11,5	9,5	11,5	9	12,5	9,5	12,5	9	9	10,5
3060	14	14,5	15	1420	11,5	9	11	9	12	9,5	12	9	12,5	10	12,5	9	9	10,5
3200	14,5	15	15,5	1450	12	9	11,5	9	12,5	10	12	9,5	13	10,5	13	9,5	9	10,5
3340	14,5	15	15,5	1475	12	9	12	9	13	10	12,5	9,5	14	10,5	13	9,5	9	10,5
3480	15	15,5	16	1500	12,5	9,5	12,5	9,5	13,5	10,5	13	10	14,5	11	13,5	10	9,5	11

* Where a Steel Deck is prescribed to be fitted at the Bridge Deck, the deck below the Bridge Deck is to be a Steel Deck.

PARTIAL SUPERSTRUCTURES.

FULL SCANTLING VESSELS.

TABLE 22

(SEE CONTINUATION.)

SECOND LONGITUDINAL NUMERAL. L×(B+D)	PERCENTAGE OF LENGTH OF VESSEL COVERED BY SUPERSTRUCTURES. 40	60	80	BREADTH OF STRINGER PLATE.	PROPORTION OF LENGTH OF VESSEL TO DEPTH TO BRIDGE DECK. 10												Deck Plating within Line of Deck Openings.	Minimum for Unsheathed Deck Plating abreast Deck Openings.
	THICKNESS OF BRIDGE SIDE PLATING.				PERCENTAGE OF LENGTH OF VESSEL COVERED BY SUPERSTRUCTURES.													
					40				60				80					
					THICKNESS OF "LONG" BRIDGE DECK.													
					When Two Steel Decks are Fitted including Bridge Deck.		When Three Steel Decks are Fitted including Bridge Deck.		When Two Steel Decks are Fitted including Bridge Deck.		When Three Steel Decks are Fitted including Bridge Deck.		When Two Steel Decks are Fitted including Bridge Deck.		When Three Steel Decks are Fitted including Bridge Deck.			
					Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating		
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
3620	15	15,5	16,5	1525	12,5	10,5	12,5	10	13,5	11,5	13	10	14,5	12	13,5	10	9,5	11
3760	15,5	16	17	1550	13,5	11	13	10	14	12	13,5	10,5	15	13	14	10,5	10	11
3900	15,5	16,5	17	1575	14	12	13,5	10	14,5	13	14	10,5	15	13,5	15	11	10	11,5
4040	15,5	16,5	17	1600			13,5	10,5			14	11			15	11,5	10,5	11,5
4180	16	17	17,5	1625			14,5	10,5			15	11,5			15,5	12	10,5	11,5
4320	16,5	17	17,5	1650			14,5	11			15	12			15,5	13	10,5	11,5
4460	17	17,5	18	1675			15	11,5			15,5	12,5			16	13,5	10,5	12
4640	17	17,5	18	1725			15	12,5			15,5	13,5			16,5	14	11	12
4830	17,5	18	18,5	1755			15,5	13,5			16,5	14,5			17	15	11	12
5020	17,5	18	18,5	1780			15,5	14,5			17	15,5			17,5	16,5	11	12
5200	17,5	18,5	19	1830			16,5	15,5			17	17			17,5	17,5	11,5	12
5390	17,5	18,5	19	1880			17	17			18	18			18,5	18,5	11,5	12
5570	18	19	19,5	1930			18	18			18,5	18,5			19	19	11,5	12
5760	18	19	19,5	1980			19	19			19,5	19,5			20	20	12	12
5950	18,5	19,5	20	2005			19,5	19,5			20,5	20,5			21	21	12	12
6130	18,5	19,5	20	2030			20,5	20,5			21,5	21,5			22	22	12	12
6320	19	20	20,5	2055			21,5	21,5			22	22			22,5	22,5	12	12
6500	19	20	20,5	2110			22	22			23	23			23,5	23,5	12,5	12,5
6690	19,5	20,5	21	2160			23	23			23,5	23,5			24	24	12,5	12,5
6880	19,5	20,5	21,5	2185			23,5	23,5			24	24			24,5	24,5	12,5	12,5
7060	20	21	22	2235			24	24			25	25			25,5	25,5	12,5	12,5

PARTIAL SUPERSTRUCTURES.

FULL SCANTLING VESSELS.

TABLE 22

(SEE CONTINUATION.)

PROPORTION OF LENGTH OF VESSEL TO DEPTH TO BRIDGE DECK.

11

SECOND LONGITUDINAL NUMERAL. L×(B+D)	PERCENTAGE OF LENGTH OF VESSEL COVERED BY SUPERSTRUCTURES. 40	60	80	BREADTH OF STRINGER PLATE.	PERCENTAGE OF LENGTH OF VESSEL COVERED BY SUPERSTRUCTURES. 40 — THICKNESS OF "LONG" BRIDGE DECK. When Two Decks are Fitted including Bridge Deck. Stringer Plate.	When Two Decks are Fitted including Bridge Deck. Tie Plates and Deck Plating. *	When Three Steel Decks are Fitted including Bridge Deck. Stringer Plate.	When Three Steel Decks are Fitted including Bridge Deck. Deck Plating.	60 — When Two Decks are Fitted including Bridge Deck. Stringer Plate.	When Two Decks are Fitted including Bridge Deck. Tie Plates and Deck Plating. *	When Three Steel Decks are Fitted including Bridge Deck. Stringer Plate.	When Three Steel Decks are Fitted including Bridge Deck. Deck Plating.	80 — When Two Decks are Fitted including Bridge Deck. Stringer Plate.	When Two Decks are Fitted including Bridge Deck. Tie Plates and Deck Plating. *	When Three Steel Decks are Fitted including Bridge Deck. Stringer Plate.	When Three Steel Decks are Fitted including Bridge Deck. Deck Plating.	Deck Plating within Line of Deck Openings.	Minimum for Unsheathed Deck Plating abreast Deck Openings.
	THICKNESS OF BRIDGE SIDE PLATING.																	
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
1115	10	10,5	11	1145	1065 × 9,5	305 × 9,5			1065 × 10	305 × 10			1065 × 10,5	305 × 10,5			7,5	8
1210	10	10,5	11	1145	1065 × 9,5	355 × 9,5			1065 × 10	355 × 10			1065 × 10,5	355 × 10,5			7,5	8
1300	10	10,5	11	1145	1090 × 9,5	405 × 9,5			1090 × 10	405 × 10			1090 × 10,5	405 × 10,5			7,5	8
1390	10,5	11	11,5	1145	1120 × 10	405 × 10			1145 × 10,5	430 × 10,5			1145 × 11	455 × 11			7,5	8
1485	10,5	11	11,5	1145	1120 × 10	485 × 10			1170 × 10,5	560 × 10,5			1195 × 11	610 × 11			7,5	8
1580	11	11,5	12	1145	1195 × 10,5	560 × 10			1245 × 11	610 × 11			1295 × 11,5	660 × 11,5			7,5	8,5
1670	11	11,5	12	1145	1270 × 10,5	685 × 10,5	9		1320 × 11	735 × 11	9		1370 × 11,5	785 × 11,5	9,5		7,5	8,5
1765	11,5	12	12,5	1170	1320 × 11	785 × 11	9		1320 × 11,5	835 × 11,5	9,5		1420 × 12	890 × 12	10		7,5	8,5
1860	11,5	12	12,5	1170	1370 × 11	965 × 11	9		1420 × 11,5	990 × 11,5	9,5		1475 × 12	1015 × 12	10		7,5	8,5
1950	12	12,5	13	1195	10,5	7,5	9,5	7,5	11	7,5	10	7,5	11	7,5	10,5	7,5	7,5	9
2045	12	12,5	13	1220	10,5	8	9,5	8	11	8	10	8	11	8	10,5	8	8	9
2135	12,5	13	13,5	1245	11	8	10	8	11	8	10,5	8	11,5	8	11	8	8	9
2230	12,5	13	13,5	1270	11	8	10,5	8	11,5	8	10,5	8	12	8	11	8	8	9,5
2370	13	13,5	14	1295	11,5	8,5	10,5	8,5	12	8,5	11	8,5	12,5	8,5	11,5	8,5	8	9,5
2510	13	13,5	14	1320	11,5	8,5	11	8,5	12	9	11,5	8,5	12,5	9	12	8,5	8,5	10
2650	13,5	14	14,5	1345	12	8,5	11	8,5	12,5	9	11,5	8,5	13	9,5	12	8,5	8,5	10
2785	13,5	14	14,5	1370	12	9	11	9	12,5	9,5	12	9	13	10,5	12,5	9	8,5	10
2925	14	14,5	15	1395	12,5	9	11,5	9	13	10	12,5	9	13,5	11	13	9	9	10,5
3060	14	14,5	15	1420	13	9,5	12	9	13,5	11	13	9,5	13,5	12	13,5	9,5	9	10,5
3200	14,5	15	15,5	1450	13,5	10,5	12	9,5	14	11,5	13	9,5	14	12,5	14	10	9	10,5
3340	14,5	15	15,5	1475	13,5	11,5	12	9,5	14	12,5	13	10	14	13,5	14	10,5	9	10,5
3480	15	15,5	16	1500	14	12,5	12,5	9,5	14,5	13,5	13,5	10,5	14,5	14	14,5	11	9,5	11

* Where a Steel Deck is prescribed to be fitted at the Bridge Deck, the deck below the Bridge Deck is to be a Steel Deck.

PARTIAL SUPERSTRUCTURES.

FULL SCANTLING VESSELS.

TABLE 22 (CONCLUDED.)

SECOND LONGITUDINAL NUMERAL. L×(B+D)	PERCENTAGE OF LENGTH OF VESSEL COVERED BY SUPER-STRUCTURES.			BREADTH OF STRINGER PLATE.	PROPORTION OF LENGTH OF VESSEL TO DEPTH TO BRIDGE DECK. 11												Deck Plating within Line of Deck Openings.	Minimum for Unsheathed Deck Plating abreast Deck Openings.
	PERCENTAGE OF LENGTH OF VESSEL COVERED BY SUPERSTRUCTURES.				40				60				80					
	THICKNESS OF BRIDGE SIDE PLATING.				THICKNESS OF "LONG" BRIDGE DECK.													
					When Two Steel Decks are Fitted including Bridge Deck.		When Three Steel Decks are Fitted including Bridge Deck.		When Two Steel Decks are Fitted including Bridge Deck.		When Three Steel Decks are Fitted including Bridge Deck.		When Two Steel Decks are Fitted including Bridge Deck.		When Three Steel Decks are Fitted including Bridge Deck.			
	40	60	80		Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.		
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
3620	15	15,5	16,5	1525	14	13,5	13,5	10	15	14	14	11	15	14,5	14,5	12	9·5	11
3760	15,5	16	17	1550	14,5	14	14	11	15	15	14,5	12	15,5	15,5	15	12,5	10	11
3900	15,5	16,5	17	1575	15	15	14	11,5	15,5	15,5	14,5	12,5	16,5	16	15	13,5	10	11,5
4040	15,5	16,5	17	1600			14	12,5			14,5	13,5			15	14,5	10,5	11,5
4180	16	17	17,5	1625			14,5	13			15	14,5			15,5	15,5	10,5	11,5
4320	16,5	17	17,5	1650			14,5	14			15,5	15,5			17	17	10,5	11,5
4460	17	17,5	18	1675			15,5	14,5			17	16,5			18	18	10,5	12
4640	17	17,5	18	1725			16,5	16,5			18	18			19	19	11	12
4830	17,5	18	18,5	1755			17	17			18,5	18,5			19,5	19,5	11	12
5020	17,5	18	18,5	1780			18	18			19,5	19,5			20,5	20,5	11	12
5200	17,5	18,5	19	1830			19	19			20	20			21	21	11,5	12
5390	17,5	18,5	19	1880			20	20			21	21			22	22	11,5	12
5570	18	19	19,5	1930			20,5	20,5			21,5	21,5			22,5	22,5	11,5	12
5760	18	19	19,5	1980			21,5	21,5			22,5	22,5			23,5	23,5	12	12
5950	18,5	19,5	20	2005			22,5	22,5			23,5	23,5			24	24	12	12
6130	18,5	19,5	20	2030			23,5	23,5			24,5	24,5			25	25	12	12
6320	19	20	20,5	2055			24	24			25	25			25,5	25,5	12	12
6500	19	20	20,5	2110			25	25			26	26			26,5	26,5	12,5	12,5
6690	19,5	20,5	21	2160			26	26			27	27			27,5	27,5	12,5	12,5
6880	19,5	20,5	21,5	2185			27	27			28	28			28,5	28,5	12,5	12,5
7060	20	21	22	2235			27,5	27,5			28,5	28,5			29,5	29,5	12,5	12,5

PARTIAL SUPERSTRUCTURES.

COMPLETE SUPERSTRUCTURE VESSELS.

TABLE 23

(SEE CONTINUATION.)

SECOND LONGITUDINAL NUMERAL. $L \times (B+D)$	THICKNESS OF BRIDGE SIDE PLATING.	BREADTH OF STRINGER PLATE.	PROPORTION OF LENGTH OF VESSEL TO DEPTH TO BRIDGE DECK. 10 — THICKNESS OF "LONG" BRIDGE DECK.							
			When Two Decks are Fitted including Bridge Deck.		When Three Steel Decks are Fitted including Bridge Deck.		When Four Steel Decks are Fitted including Bridge Deck.		Deck Plating within Line of Deck Openings.	Minimum for Unsheathed Deck Plating abreast Deck Openings.
			Stringer Plate.	Tie Plates and Deck Plating. *	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.		
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
1115	9,5	1145	1065 × 9	305 × 9					7,5	8
1210	9,5	1145	1065 × 9	305 × 9					7,5	8
1300	9,5	1145	1065 × 9	330 × 9					7,5	8
1390	10	1145	1065 × 9,5	355 × 9,5					7,5	8
1485	10	1145	1090 × 10	355 × 10					7,5	8
1580	10	1145	1120 × 10	405 × 10					7,5	8,5
1670	10,5	1145	1145 × 10,5	430 × 10,5	8,5				7,5	8,5
1765	10,5	1170	1170 × 10,5	510 × 10,5	8,5				7,5	8,5
1860	10,5	1170	1220 × 10,5	610 × 10,5	8,5				7,5	8,5
1950	11	1195	1270 × 10,5	760 × 10,5	9				7,5	9
2045	11	1220	1270 × 10,5	915 × 10,5	9				8	9
2135	11	1245	9	8	9	8			8	9
2230	11,5	1270	9,5	8	9	8			8	9,5
2370	11,5	1295	9,5	8	9,5	8			8	9,5
2510	11,5	1320	9,5	8,5	9,5	8,5			8,5	10
2650	12	1345	10	8,5	9,5	8,5			8,5	10
2785	12	1370	10	8,5	10	8,5			8,5	10
2925	12,5	1395	10	9	10	9			9	10,5
3060	12,5	1420	10,5	9	10	9			9	10,5
3200	13	1450	10,5	9	10,5	9			9	10,5
3340	13	1475	11	9	10,5	9			9	10,5
3480	13	1500	11	9,5	11	9,5			9,5	11
3620	13,5	1525	11,5	9,5	11	9,5			9,5	11
3760	13,5	1550	11,5	10	11,5	10	11,5	10	10	11

* Where a Steel Deck is prescribed to be fitted at the Bridge Deck, the deck below the Bridge Deck is to be a Steel Deck.

PARTIAL SUPERSTRUCTURES.
COMPLETE SUPERSTRUCTURE VESSELS.

TABLE 23
(SEE CONTINUATION.)

SECOND LONGITUDINAL NUMERAL. $L \times (B+D)$	THICKNESS OF BRIDGE SIDE PLATING.	BREADTH OF STRINGER PLATE.	PROPORTION OF LENGTH OF VESSEL TO DEPTH TO BRIDGE DECK. 10 — THICKNESS OF "LONG" BRIDGE DECK.						Deck Plating within Line of Deck Openings.	Minimum for Unsheathed Deck Plating abreast Deck Openings.
			When Two Steel Decks are Fitted including Bridge Deck.		When Three Steel Decks are Fitted including Bridge Deck.		When Four Steel Decks are Fitted including Bridge Deck.			
			Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.		
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
3900	14	1575	11,5	10	11,5	10	11,5	10	10	11,5
4040	14	1600			12	10,5	11,5	10,5	10,5	11,5
4180	14	1625			12	10,5	12	10,5	10,5	11,5
4320	14,5	1650			12,5	10,5	12	10,5	10,5	11,5
4460	14,5	1675			12,5	10,5	12,5	10,5	10,5	12
4640	15	1725			13	11	12,5	11	11	12
4830	15	1755			13,5	11	13	11	11	12
5020	15,5	1780			14	11	13	11	11	12
5200	15,5	1830			14	12	13,5	11,5	11,5	12
5390	16	1880			14,5	13	14	12,5	11,5	12
5570	16,5	1930			15	14	14,5	13	11,5	12
5760	17	1955			15,5	14,5	15	13,5	12	12
5950	17	2005			15,5	15,5	15	14,5	12	12
6130	17,5	2030			16,5	16,5	15	15	12	12
6320	17,5	2055			17,5	17,5	16,5	16,5	12	12
6500	18	2110			18,5	18,5	17,5	17,5	12,5	12,5
6690	18	2160			19,5	19,5	18,5	18,5	12,5	12,5
6880	18,5	2185			20,5	20,5	19,5	19,5	12,5	12,5
7060	18,5	2235			21,5	21,5	20,5	20,5	12,5	12,5
7250	19	2260			22,5	22,5	21,5	21,5	13	13
7430	19	2285			23,5	23,5	22,5	22,5	13	13
7620	19,5	2335			24,5	24,5	23,5	23,5	13	13
7850	19,5	2390			25,5	25,5	24,5	24,5	13,5	13,5
8080	19,5	2440			26,5	26,5	25,5	25,5	13,5	13,5

PARTIAL SUPERSTRUCTURES.
COMPLETE SUPERSTRUCTURE VESSELS.

TABLE 23
(SEE CONTINUATION.)

SECOND LONGITUDINAL NUMERAL. $L \times (B+D)$	THICKNESS OF BRIDGE SIDE PLATING.	BREADTH OF STRINGER PLATE.	PROPORTION OF LENGTH OF VESSEL TO DEPTH TO BRIDGE DECK. 11 — THICKNESS OF "LONG" BRIDGE DECK.						Deck Plating within Line of Deck Openings.	Minimum for Unsheathed Deck Plating abreast Deck Openings.
			When Two Decks are Fitted including Bridge Deck.		When Three Steel Decks are Fitted including Bridge Deck.		When Four Steel Decks are Fitted including Bridge Deck.			
			Stringer Plate.	Tie Plates and Deck Plating.*	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.		
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
1115	9,5	1145	1065 × 9	305 × 9					7,5	8
1210	9,5	1145	1065 × 9	330 × 9					7,5	8
1300	9,5	1145	1065 × 9	355 × 9					7,5	8
1390	10	1145	1065 × 9,5	380 × 9,5					7,5	8
1485	10	1145	1090 × 10	430 × 10					7,5	8
1580	10	1145	1145 × 10	510 × 10					7,5	8,5
1670	10,5	1145	1145 × 10,5	610 × 10,5	8,5				7,5	8,5
1765	10,5	1170	1220 × 10,5	710 × 10,5	8,5				7,5	8,5
1860	10,5	1170	1270 × 10,5	815 × 10,5	8,5				7,5	8,5
1950	11	1195	1320 × 10,5	915 × 10,5	9				7,5	9
2045	11	1220	9,5	8	9	8			8	9
2135	11	1245	9,5	8	9	8			8	9
2230	11,5	1270	10	8	9	8			8	9,5
2370	11,5	1295	10	8	9,5	8			8	9,5
2510	11,5	1320	10	8,5	9,5	8,5			8,5	10
2650	12	1345	10,5	8,5	10	8,5			8,5	10
2785	12	1370	10,5	9	10	9			9	10
2925	12,5	1395	10,5	9	10	9			9	10,5
3060	12,5	1420	11	9	10,5	9			9	10,5
3200	13	1450	11	9	10,5	9			9	10,5
3340	13	1475	11	9,5	11	9,5			9	10,5
3480	13	1500	11,5	9,5	11	9,5			9,5	11
3620	13,5	1525	11,5	9,5	11,5	9,5			9,5	11
3760	13,5	1550	11,5	10	11,5	10	11,5	10	10	11

* Where a Steel Deck is prescribed to be fitted at the Bridge Deck, the deck below the Bridge Deck is to be a Steel Deck.

PARTIAL SUPERSTRUCTURES.
COMPLETE SUPERSTRUCTURE VESSELS.

TABLE 23
(CONCLUDED.)

SECOND LONGITUDINAL NUMERAL. L×(B+D)	THICKNESS OF BRIDGE SIDE PLATING.	BREADTH OF STRINGER PLATE.	PROPORTION OF LENGTH OF VESSEL TO DEPTH TO BRIDGE DECK. 11 — THICKNESS OF "LONG" BRIDGE DECK.							
			When Two Steel Decks are Fitted including Bridge Deck.		When Three Steel Decks are Fitted including Bridge Deck.		When Four Steel Decks are Fitted including Bridge Deck.		Deck Plating within Line of Deck Openings.	Minimum for Unsheathed Deck Plating abreast Deck Openings.
			Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.		
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
3900	14	1575	12	10	12	10	11,5	10	10	11,5
4040	14	1600			12	10,5	12	10,5	10,5	11,5
4180	14	1625			12	10,5	12	10,5	10,5	11,5
4320	14,5	1650			12,5	10,5	12,5	10,5	10,5	11,5
4460	14,5	1675			13	10,5	12,5	10,5	10,5	12
4640	15	1725			13,5	11	13	11	11	12
4830	15	1755			14,5	12	13,5	11,5	11	12
5020	15,5	1780			15	12,5	14	12	11	12
5200	15,5	1830			15	13,5	14	13	11,5	12
5390	16	1880			15	14,5	14,5	13,5	11,5	12
5570	16,5	1930			15,5	15,5	15	14	11,5	12
5760	17	1955			16,5	16,5	15	15	12	12
5950	17	2005			17,5	17,5	16,5	16,5	12	12
6130	17,5	2030			18,5	18,5	17,5	17,5	12	12
6320	17,5	2055			19,5	19,5	18,5	18,5	12	12
6500	18	2110			20,5	20,5	19,5	19,5	12,5	12,5
6690	18	2160			21,5	21,5	20,5	20,5	12,5	12,5
6880	18,5	2185			22,5	22,5	21,5	21,5	12,5	12,5
7060	18,5	2235			24	24	23	23	12,5	12,5
7250	19	2260			26	26	25	25	13	13
7430	19	2285			27,5	27,5	26,5	26,5	13	13
7620	19,5	2335					28,5	28,5	13	13
7850	19,5	2390					31	31	13,5	13,5
8080	19,5	2440							13,5	13,5

TABLE 24

STRINGER ANGLES on UPPER DECKS and LONG BRIDGES.

STRINGER ANGLES.		
THICKNESS OF SHEERSTRAKE OR STRINGER WHICHEVER IS THE GREATER.	DIAMETER OF RIVET AS REQUIRED BY TABLE 38.	SIZES OF FLANGES. *
mm. Not exceeding 9	mm. 16	mm. 75 × 75
9 to 12,5	19	90 × 90
12,5 „ 16,5	22	130 × 130
16,5 „ 18,5	22	150 × 150
18,5 „ 24,5	25	150 × 150
24,5 „ 29	28	180 × 180
29 „ 30,5	32	200 × 200

* The thickness of the Gunwale Angle may be that of the Sheerstrake or Stringer Plate, whichever is the less.

LLOYD'S REGISTER OF SHIPPING, LONDON.—17*th May*, 1928.

"SHORT" SUPERSTRUCTURES. TABLE 25

SECOND LONGITUDINAL NUMERAL. L×(B+D)	"SHORT" SUPERSTRUCTURES.											
	POOPS.				"SHORT" BRIDGES.				FORECASTLES.			
	Thickness of Side Plating.	Stringer Angle.	Thickness.		Thickness of Side Plating.	Stringer Angle.	Thickness.		Thickness of Side Plating	Stringer Angle.	Thickness.	
			Stringer Plate.	Tie Plates.			Stringer Plate.	Tie Plates and Deck Plating.			Stringer Plate.	Tie Plates and Deck Plating.
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
140	5,5	65×65× 5,5	255× 5,5	125× 5,5	5,5	65×65× 5,5	355× 5,5	125×5,5	5,5	65×65× 5,5	255× 5,5	125×5,5
185	5,5	65×65× 5,5	280× 5,5	125× 5,5	5,5	65×65× 5,5	405× 5,5	125×5,5	5,5	65×65× 5,5	280× 5,5	125×5,5
230	5,5	65×65× 5,5	280× 5,5	125× 5,5	5,5	65×65× 5,5	455× 5,5	125×5,5	5,5	65×65× 5,5	280× 5,5	125×5,5
280	5,5	65×65× 5,5	305× 5,5	150× 5,5	5,5	65×65× 5,5	510× 5,5	150×5,5	5,5	65×65× 5,5	305× 5,5	150×5,5
345	6	65×65× 6	330× 6	150× 6	6	65×65× 6	560× 6	150×6	6	65×65× 6	330× 6	150×6
410	6	65×65× 6	330× 6	150× 6	6	65×65× 6	610× 6	150×6	6	65×65× 6	330× 6	150×6
485	6	65×65× 6	355× 6	150× 6	6	65×65× 6	660× 6	150×6	6	65×65× 6	355× 6	150×6
565	6	75×75× 6	380× 6	150× 6	6	75×75× 6	710× 6	150×6	6	75×75× 6	380× 6	150×6
660	6,5	75×75× 6,5	405× 6,5	180× 6,5	6,5	75×75× 6,5	760× 6,5	180×6,5	6,5	75×75× 6,5	405× 6,5	180×6,5
760	6,5	75×75× 6,5	430× 6,5	180× 6,5	6,5	75×75× 6,5	785× 6,5	180×6,5	6,5	75×75× 6,5	430× 6,5	180×6,5
890	6,5	75×75× 6,5	455× 6,5	180× 6,5	7	75×75× 7	815× 7	180×7	7	75×75× 7	455× 7	180×7
1020	7	75×75× 7	510× 7	180× 7	7,5	75×75× 7,5	840× 7,5	180×7,5	7,5	75×75× 7,5	510× 7,5	180×7,5
1170	7	75×75× 7	560× 7	180× 7	7,5	75×75× 7,5	840× 7,5	180×7,5	7,5	75×75× 7,5	560× 7,5	180×7,5
1355	7,5	75×75× 7,5	610× 7,5	205× 7,5	8	75×75× 8	865× 8	205×8	8	75×75× 7,5	610× 7,5	Dk.Pltg. 7,5
1580	8	75×75× 7,5	660× 7,5	205× 7,5	8,5	75×75× 8,5	890× 8,5	205×8,5	8,5	75×75× 8	660× 8	7,5
1810	8,5	75×75× 8	710× 8	205× 8	9	75×75× 9	915× 9	205×9	9	75×75× 8	710× 8	7,5
2060	8,5	75×75× 8	760× 8	205× 8	9,5	75×75× 9,5	940× 9,5	230×9,5	9,5	75×75× 8	760× 8	8
2320	9	75×75× 8	815× 8	230× 8	9,5	75×75× 9,5	965× 9,5	230×9,5	9,5	75×75× 8	815× 8	8
2585	9	90×90× 8,5	840× 8,5	230× 8,5	10	90×90×10	965×10	Dk.Pltg. 7,5	10	90×90× 8,5	840× 8,5	8
2845	9,5	90×90× 8,5	865× 8,5	230× 8,5	10	90×90×10	990×10	7,5	10	90×90× 8,5	865× 8,5	8,5
3105	9,5	90×90× 8,5	890× 8,5	230× 8,5	10	90×90×10	990×10	8	10	90×90× 8,5	865× 8,5	8,5
3365	9,5	90×90× 9	915× 9	230× 9	10,5	90×90×10,5	1015×10,5	8	10,5	90×90× 9	890× 9	8,5
3625	10	90×90× 9	940× 9	230× 9	10,5	90×90×10,5	1040×10,5	8	10,5	90×90× 9	890× 9	8,5
3885	10	90×90× 9	940× 9	255× 9	10,5	90×90×10,5	1040×10,5	8,5	10,5	90×90× 9	890× 9	9
4145	10	90×90× 9,5	965× 9,5	255× 9,5	11	90×90×11	1065×11	8,5	11	90×90× 9,5	915× 9,5	9
4405	10,5	90×90× 9,5	990× 9,5	255× 9,5	11	90×90×11	1090×11	8,5	11	90×90× 9,5	915× 9,5	9
4665	10,5	90×90× 9,5	990× 9,5	255× 9,5	11	90×90×11	1090×11	9	11	90×90× 9,5	915× 9,5	9
4925	10,5	90×90×10	1015×10	255×10	11,5	90×90×11,5	1120×11,5	9	11,5	90×90×10	940×10	9
5180	10,5	90×90×10	1040×10	255×10	11,5	90×90×11,5	1145×11,5	9,5	11,5	90×90×10	940×10	9,5
5445	11	90×90×10	1040×10	280×10	11,5	90×90×11,5	1145×11,5	9,5	11,5	90×90×10	940×10	9,5
5705	11	90×90×10	1065×10	280×10	12	90×90×12	1170×12	9,5	12	90×90×10	940×10	9,5
5965	11	90×90×10,5	1090×10,5	280×10,5	12	90×90×12	1195×12	9,5	12	90×90×10,5	965×10,5	9,5
6225	11,5	90×90×10,5	1090×10,5	280×10,5	12	90×90×12	1195×12	9,5	12	90×90×10,5	965×10,5	9,5
6485	11,5	90×90×10,5	1120×10,5	280×10,5	12,5	90×90×12,5	1220×12,5	9,5	12,5	90×90×10,5	965×10,5	9,5
6745	11,5	90×90×10,5	1120×10,5	280×10,5	12,5	90×90×12,5	1245×12,5	10	12,5	90×90×10,5	965×10,5	10
7005	11,5	90×90×11	1145×11	305×11	12,5	90×90×12,5	1245×12,5	10	12,5	90×90×11	970×11	10
7265	12	90×90×11	1170×11	305×11	13	90×90×13	1270×13	10	13	90×90×11	990×11	10
7530	12	90×90×11	1170×11	305×11	13	90×90×13	1295×13	10	13	90×90×11	1015×11	10

LOWER DECKS. TABLE 26

SECOND LONGITUDINAL NUMERAL. $L \times (B+D)$.	ALL LOWER DECKS.	SECOND DECK WHERE A STEEL DECK IS FITTED.			SECOND DECK WHERE STRINGERS AND TIES ARE FITTED.		THIRD DECK.		DECKS BELOW THIRD DECK.		ALL LOWER DECKS.			
		HALF LENGTH AMIDSHIPS.									STRINGER ANGLE.			
	Breadth of Stringer Plate for ½-Length Amidships.	Thickness.			Thickness of Stringer Plate.	Tie Plates.	Thickness.		Thickness.		Half Length Amidships.	At Ends.	Stringer Plates at Ends also Thickness of Tie Plates at Ends.	Thickness of Deck Plating at Ends.
		Stringer Plate.	Deck Plating abreast Line of Openings.	Deck Plating Inside Line of Openings.			Stringer Plate.	Deck Plating.	Stringer Plate.	Deck Plating.				
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
835	1040				8,5	230 × 8,5					75 × 75 × 8,5	8,5	610 × 8,5	
975	1040				8,5	230 × 8,5					75 × 75 × 8,5	8,5	635 × 8,5	
1125	1065	8,5	7,5	7,5	9	255 × 9					75 × 75 × 8,5	8,5	660 × 8,5	7,5
1280	1065	8,5	7,5	7,5	9	255 × 9					75 × 75 × 8,5	8,5	685 × 8,5	7,5
1460	1090	8,5	7,5	7,5	9,5	280 × 9,5					75 × 75 × 8,5	8,5	710 × 8,5	7,5
1645	1090	8,5	7,5	7,5	10	305 × 10					90 × 90 × 8,5	8,5	735 × 8,5	7,5
1840	1120	8,5	7,5	7,5	10,5	330 × 10,5	8,5	7,5			90 × 90 × 9	8,5	760 × 8,5	7,5
2055	1120	8,5	7,5	7,5	10,5	330 × 10,5	8,5	7,5			90 × 90 × 9	8,5	785 × 8,5	7,5
2275	1145	9	8	7,5	11	355 × 11	8,5	7,5			90 × 90 × 9	8,5	815 × 8,5	7,5
2510	1145	9	8	8	11	355 × 11	8,5	7,5			90 × 90 × 9,5	8,5	840 × 8,5	7,5
2750	1170	9,5	8,5	8	11,5	380 × 11,5	9	8			90 × 90 × 9,5	8,5	865 × 8,5	7,5
3010	1195	9,5	8,5	8	11,5	380 × 11,5	9	8			90 × 90 × 10	8,5	890 × 8,5	7,5
3280	1195	10	9	8,5			9	8			90 × 90 × 10	8,5	890 × 8,5	7,5
3560	1220	10	9	8,5			9,5	8,5			90 × 90 × 10,5	8,5	915 × 8,5	7,5
3845	1245	10,5	9,5	8,5			9,5	8,5			90 × 90 × 11	9	940 × 9	8
4145	1270	11	10	8,5			9,5	8,5			90 × 90 × 11	9	965 × 9	8
4440	1295	11,5	10,5	9			10	9			90 × 90 × 11,5	9	990 × 9	8
4735	1295	11,5	10,5	9			10	9			90 × 90 × 11,5	9	990 × 9	8
5035	1320	12	11	9			10	9	9,5	8,5	90 × 90 × 12	9	1015 × 9	8
5335	1345	12	11	9			10,5	9,5	10	9	90 × 90 × 12	9,5	1040 × 9,5	8,5
5630	1370	12,5	11,5	9,5			10,5	9,5	10	9	90 × 90 × 12,5	9,5	1040 × 9,5	8,5
5930	1370	12,5	11,5	9,5			11	10	10	9	90 × 90 × 12,5	9,5	1065 × 9,5	8,5
6225	1395	13	12	10			11	10	10	9	90 × 90 × 13	9,5	1090 × 9,5	8,5
6540	1420	13	12	10			11,5	10,5	10,5	9,5	90 × 90 × 13	10	1090 × 10	9
6875	1450	13,5	12,5	10			11,5	10,5	10,5	9,5	90 × 90 × 13,5	10	1120 × 10	9
7220	1450	13,5	12,5	10			12	11	11	10	100 × 100 × 13,5	10	1145 × 10	9
7565	1475	14	13	10,5			12	11	11	10	100 × 100 × 14	10	1145 × 10	9
7915	1475	14	13	10,5			12,5	11,5	11,5	10,5	100 × 100 × 14	10,5	1170 × 10,5	9,5
8280	1500	14,5	13,5	10,5			12,5	11,5	11,5	10,5	100 × 100 × 14,5	10,5	1195 × 10,5	9,5
8650	1500	14,5	13,5	10,5			13	12	11,5	10,5	100 × 100 × 14,5	10,5	1195 × 10,5	9,5
8940	1525	15	14	11			13	12	12	11	100 × 100 × 15	10,5	1220 × 10,5	9,5

In way of a partial superstructure exceeding 15 per cent of the vessel's length, the thickness of the second deck may be as required for a third deck, and the thickness of the third deck may be as required for decks below third deck.

LLOYD'S REGISTER OF SHIPPING, LONDON.—13*th July*, 1922.

BULKHEAD STIFFENERS spaced 760 mm. apart and fitted with BRACKET ATTACHMENTS at top and bottom in accordance with Table 30.

TABLE 27

(SEE CONTINUATION.)

Overall Length of Stiffener, Including End Attachments.		HEIGHT OF TOP OF BULKHEAD AT MIDDLE LINE ABOVE TOP OF STIFFENER.					
		Metres. 0	Metres. 0,6	Metres. 1,2	Metres. 1,85	Metres. 2,45	Metres. 3,05
Metres. 2,45	ANGLES ^	mm. 100×75× 8	mm. 120×75× 7,5	mm. 120×75× 8,5	mm. 130×75× 8	mm. 140×75× 8	mm. 140×75× 9
2,75		120×75× 8	130×75× 8	130×75× 9	140×75× 9	150×75× 9,5	150×75×10
3,05		130×75× 8,5	140×75× 8,5	150×75× 9	150×75×10	140×65× 8	150×70× 8,5
3,35		140×75× 9	150×75× 9,5	140×65× 8	140×65× 9,5	150×70× 8,5	150×70× 9
3,65	v	150×75×10	140×65× 8,5	150×70× 8,5	150×70× 9,5	170×75× 9	180×75× 9
3,95	BULB ANGLES ^	140×65× 9	150×70× 9	170×75× 8,5	170×75× 9,5	180×75× 9,5	190×75× 9,5
4,25		150×70× 9	170×75× 8,5	180×75× 9,0	180×75×10	190×75×10	200×75×10,5
4,55		170×75× 8,5	180×75× 9	190×75× 9,5	190×75×10,5	200×75×11	220×75×10,5
4,9		180×75× 9	190×75× 9,5	200×75×10,5	200×75×11,5	220×75×11	220×75×12,5
5,2		190×75× 9,5	200×75×10,5	220×75×10,5	220×75×11,5	220×75×13	240×90×11,5
5,5		200×75×10,5	220×75×10,5	220×75×12,5	220×75×13,5	240×90×11,5	250×90×12
5,8		220×75×10,5	220×75×12,5	220×75×14	240×90×12	250×90×12,5	270×90×12
6,1		220×75×12,5	240×90×11,5	250×90×12	270×90×12,5	270×90×13	280×90×12
6,4		240×90×11,5	250×90×12	270×90×11,5	280×90×12	280×90×12,5	290×90×13,5
6,7		250×90×12	270×90×11,5	280×90×12	290×90×12,5	300×95×13	300×95×14
7,0		270×90×11,5	280×90×12	290×90×12,5	300×95×13	300×95×14,5	280×100×100 12/16,5
7,3		280×90×12	290×90×12,5	300×95×13	280×100×100 12/16,5	280×100×100 13/16,5	300×100×100 12/17
7,6		290×90×12,5	300×95×13	280×100×100 12/16,5	280×100×100 14/16,5	300×100×100 12,5/17	320×100×100 12/17,5
7,9	v	300×95×13	280×100×100 12/16,5	280×100×100 14/16,5	300×100×100 13,5/17	320×100×100 12,5/17,5	320×100×100 14/17,5
8,25	CHANNELS	280×100×100 12/16,5	280×100×100 13/16,5	300×100×100 12,5/17	320×100×100 13,5/17,5	340×100×100 13/18	

BULKHEAD STIFFENERS spaced 760 mm. apart and fitted with BRACKET ATTACHMENTS at top and bottom in accordance with Table 30.

TABLE 27

(SEE CONTINUATION.)

Overall Length of Stiffener, Including End Attachments.		HEIGHT OF TOP OF BULKHEAD AT MIDDLE LINE ABOVE TOP OF STIFFENER.				
		Metres. 3,65	Metres. 4,25	Metres. 4,9	Metres. 5,5	Metres. 6,1
Metres. 2,45	ANGLES	mm. 150 × 75 × 9	mm. 150 × 75 × 9,5	mm. 140 × 65 × 8	mm. 140 × 65 × 8	mm. 140 × 65 × 8,5
2,75	^	140 × 65 × 8	140 × 65 × 8,5	150 × 70 × 8,5	150 × 70 × 9	170 × 75 × 8,5
3,05		150 × 75 × 9	150 × 75 × 9,5	170 × 75 × 8,5	170 × 75 × 9,5	180 × 75 × 9
3,35		170 × 75 × 8,5	180 × 75 × 9	180 × 75 × 9,5	190 × 75 × 9,5	190 × 75 × 10
3,65		180 × 75 × 9,5	190 × 75 × 9,5	190 × 75 × 10	200 × 75 × 10,5	200 × 75 × 11
3,95		190 × 75 × 10	200 × 75 × 10,5	200 × 75 × 11,5	220 × 75 × 12	220 × 75 × 12,5
4,25		200 × 75 × 11,5	220 × 75 × 10,5	220 × 75 × 12,5	220 × 75 × 12,5	240 × 90 × 11
4,55		220 × 75 × 11,5	220 × 75 × 12,5	220 × 75 × 14	240 × 90 × 11,5	250 × 90 × 12
4,9		220 × 75 × 13,5	240 × 90 × 11,5	250 × 90 × 12	270 × 90 × 11,5	270 × 90 × 12,5
5,2		240 × 90 × 12	250 × 90 × 12,5	270 × 90 × 12	280 × 90 × 12	290 × 90 × 13
5,5		270 × 90 × 11,5	280 × 90 × 12	280 × 90 × 12,5	290 × 90 × 13	300 × 95 × 13
5,8		280 × 90 × 12	290 × 90 × 13	300 × 95 × 13	300 × 95 × 13,5	280 × 100 × 100 × 12 / 16,5
6,1		290 × 90 × 13	300 × 95 × 13	300 × 95 × 14,5	280 × 100 × 100 × 12 / 16,5	280 × 100 × 100 × 13,5 / 16,5
6,4	v	300 × 95 × 13,5	280 × 100 × 100 × 12 / 16,5	280 × 100 × 100 × 12,5 / 16,5	300 × 100 × 100 × 12 / 17	300 × 100 × 100 × 12,5 / 17
6,7	^	280 × 100 × 100 × 12 / 16,5	280 × 100 × 100 × 14 / 16,5	300 × 100 × 100 × 12 / 17	320 × 100 × 100 × 12 / 17,5	320 × 100 × 100 × 12,5 / 17,5
7,0		280 × 100 × 100 × 14,5 / 16,5	300 × 100 × 100 × 12,5 / 17	320 × 100 × 100 × 12 / 17,5	340 × 100 × 100 × 12,5 / 18	340 × 100 × 100 × 13 / 18
7,3		300 × 100 × 100 × 13,5 / 17	320 × 100 × 100 × 12,5 / 17,5	340 × 100 × 100 × 12,5 / 18	340 × 100 × 100 × 15 / 18	340 × 100 × 100 × 15,5 / 18
7,6		320 × 100 × 100 × 13 / 17,5				
7,9						
8,25	v					

ANGLES — BULB ANGLES — CHANNELS

BULKHEAD STIFFENERS spaced 760 mm. apart and fitted with BRACKET ATTACHMENTS at top and bottom in accordance with Table 30.

TABLE 27

(SEE CONTINUATION.)

Overall Length of Stiffener, Including End Attachments.		HEIGHT OF TOP OF BULKHEAD AT MIDDLE LINE ABOVE TOP OF STIFFENER.				
		Metres. 6,7	Metres. 7,3	Metres. 7,9	Metres. 8,55	Metres. 9,15
Metres. 2,45	BULB ANGLES	mm. 150 × 70 × 8,5	mm. 150 × 70 × 9	mm. 150 × 70 × 10	mm. 170 × 75 × 8,5	mm. 170 × 75 × 9
2,75		170 × 75 × 9,5	170 × 75 × 10	180 × 75 × 9	180 × 75 × 10	190 × 75 × 9
3,05		180 × 75 × 10	190 × 75 × 9,5	190 × 75 × 10	190 × 75 × 10,5	200 × 75 × 10,5
3,35		200 × 75 × 10,5	200 × 75 × 11	200 × 75 × 11,5	220 × 75 × 10,5	220 × 75 × 11
3,65		220 × 75 × 10,5	220 × 75 × 11	220 × 75 × 12,5	220 × 75 × 12,5	220 × 75 × 14
3,95		220 × 75 × 13	220 × 75 × 13,5	240 × 90 × 11,5	240 × 90 × 12	250 × 90 × 12
4,25		240 × 90 × 11,5	250 × 90 × 12	250 × 90 × 12,5	270 × 90 × 11,5	270 × 90 × 12,5
4,55		270 × 90 × 11,5	270 × 90 × 12	280 × 90 × 12	280 × 90 × 12,5	290 × 90 × 12,5
4,9		280 × 90 × 12	280 × 90 × 12,5	290 × 90 × 13	300 × 95 × 13	300 × 95 × 13,5
5,2		290 × 90 × 13,5	300 × 95 × 13	300 × 95 × 13,5	280 × 100 × 100 × 12 / 16,5	280 × 100 × 100 × 12,5 / 16,5
5,5		300 × 95 × 13,5	280 × 100 × 100 × 12 / 16,5	280 × 100 × 100 × 13 / 16,5	280 × 100 × 100 × 13,5 / 16,5	300 × 100 × 100 × 12 / 17
5,8	CHANNELS	280 × 100 × 100 × 12,5 / 16,5	280 × 100 × 100 × 13,5 / 16,5	300 × 100 × 100 × 12 / 17	300 × 100 × 100 × 13 / 17	320 × 100 × 100 × 12 / 17,5
6,1		300 × 100 × 100 × 12 / 17	300 × 100 × 100 × 13 / 17	320 × 100 × 100 × 12 / 17,5	320 × 100 × 100 × 13 / 17,5	340 × 100 × 100 × 12,5 / 18
6,4		320 × 100 × 100 × 12 / 17,5	320 × 100 × 100 × 13 / 17,5	340 × 100 × 100 × 12,5 / 18	340 × 100 × 100 × 13,5 / 18	340 × 100 × 100 × 15 / 18
6,7		340 × 100 × 100 × 12,5 / 18	340 × 100 × 100 × 13,5 / 18	340 × 100 × 100 × 15 / 18	340 × 100 × 100 × 16 / 18	
7,0		340 × 100 × 100 × 15 / 18	340 × 100 × 100 × 16 / 18			
7,3						
7,6						
7,9						
8,25						

BULKHEAD STIFFENERS spaced 760 mm. apart and fitted with BRACKET ATTACHMENTS at top and bottom in accordance with Table 30.

TABLE 27 (CONCLUDED.)

Overall Length of Stiffener, Including End Attachments.		HEIGHT OF TOP OF BULKHEAD AT MIDDLE LINE ABOVE TOP OF STIFFENER.				
		Metres. 9,75	Metres. 10,35	Metres. 10,95	Metres. 11,6	Metres. 12,2
Metres.		mm.	mm.	mm.	mm.	mm.
2,45	BULB ANGLES ^	170 × 75 × 9,5	180 × 75 × 9	180 × 75 × 9,5	180 × 75 × 10	190 × 75 × 9,5
2,75		190 × 75 × 9,5	190 × 75 × 10	200 × 75 × 10	200 × 75 × 10,5	200 × 75 × 11
3,05		200 × 75 × 11	220 × 75 × 10	220 × 75 × 10,5	220 × 75 × 11,5	220 × 75 × 12,5
3,35		220 × 75 × 12,5	220 × 75 × 13	220 × 75 × 13,5	220 × 75 × 14	240 × 90 × 11,5
3,65		240 × 90 × 11,5	240 × 90 × 12	250 × 90 × 12	250 × 90 × 13	270 × 90 × 11,5
3,95		250 × 90 × 12,5	270 × 90 × 11,5	270 × 90 × 12,5	280 × 90 × 12	280 × 90 × 12,5
4,25		280 × 90 × 12	280 × 90 × 12,5	290 × 90 × 12,5	290 × 90 × 13,5	300 × 95 × 13
4,55		290 × 90 × 13,5	300 × 95 × 13	300 × 95 × 13,5	300 × 95 × 14	280 × 100 × 100 × 12 / 16,5
4,9	v	300 × 95 × 14	280 × 100 × 100 × 12 / 16,5	280 × 100 × 100 × 12,5 / 16,5	280 × 100 × 100 × 13 / 16,5	300 × 100 × 100 × 12 / 17
5,2	CHANNELS ^	280 × 100 × 100 × 13 / 16,5	300 × 100 × 100 × 12 / 17	300 × 100 × 100 × 12,5 / 17	300 × 100 × 100 × 13 / 17	320 × 100 × 100 × 12 / 17,5
5,5		300 × 100 × 100 × 12,5 / 17	320 × 100 × 100 × 12 / 17,5	320 × 100 × 100 × 12,5 / 17,5	320 × 100 × 100 × 13 / 17,5	340 × 100 × 100 × 12,5 / 18
5,8		320 × 100 × 100 × 12,5 / 17,5	340 × 100 × 100 × 12,5 / 18	340 × 100 × 100 × 13 / 18	340 × 100 × 100 × 15 / 18	340 × 100 × 100 × 15,5 / 18
6,1		340 × 100 × 100 × 13 / 18	340 × 100 × 100 × 15 / 18	340 × 100 × 100 × 15,5 / 18		
6,4		340 × 100 × 100 × 16 / 18				
6,7						
7,0						
7,3						
7,6						
7,9						
8,25	v					

BULKHEAD STIFFENERS spaced 760 mm. apart and fitted with LUG ATTACHMENTS at top and bottom in accordance with Table 30.

TABLE 28

(SEE CONTINUATION.)

Overall Length of Stiffener, Including End Attachments.		HEIGHT OF TOP OF BULKHEAD AT MIDDLE LINE ABOVE TOP OF STIFFENER.					
		Metres. 0	Metres. 0,6	Metres. 1,2	Metres. 1,85	Metres. 2,45	Metres. 3,05
Metres. 2,45	ANGLES	mm. *120 × 75 × 8,5	mm. 130 × 75 × 9	mm. 140 × 75 × 9,5	mm. 150 × 75 × 10	mm. 140 × 65 × 8,5	mm. 140 × 65 × 9,5
2,75	ANGLES	*140 × 75 × 8,5	150 × 75 × 8,5	140 × 65 × 8,5	140 × 65 × 9,5	150 × 70 × 8,5	150 × 70 × 10
3,05	ANGLES	*150 × 75 × 10	140 × 65 × 9	150 × 70 × 8,5	170 × 75 × 8,5	170 × 75 × 9,5	180 × 75 × 9
3,35	BULB ANGLES	140 × 65 × 9,5	150 × 70 × 9,5	170 × 75 × 9	180 × 75 × 9	180 × 75 × 10	190 × 75 × 10
3,65	BULB ANGLES	150 × 70 × 10	170 × 75 × 10	180 × 75 × 9,5	190 × 75 × 9,5	190 × 75 × 11,5	200 × 75 × 11,5
3,95	BULB ANGLES	170 × 75 × 8,5	180 × 75 × 10	190 × 75 × 10,5	200 × 75 × 11	220 × 75 × 10,5	220 × 75 × 12,5
4,25	BULB ANGLES	180 × 75 × 10,5	190 × 75 × 11	220 × 75 × 10,5	220 × 75 × 12	220 × 75 × 13	240 × 90 × 11,5
4,55	BULB ANGLES	190 × 75 × 11	200 × 75 × 13	220 × 75 × 12,5	220 × 75 × 14	240 × 90 × 12	250 × 90 × 12,5
4,9	BULB ANGLES	220 × 75 × 10,5	225 × 75 × 12,5	240 × 90 × 11,5	250 × 90 × 12	250 × 90 × 13,5	270 × 90 × 13
5,2	BULB ANGLES	220 × 75 × 13	240 × 90 × 11,5	250 × 90 × 12,5	270 × 90 × 12	280 × 90 × 12	280 × 90 × 13,5
5,5	BULB ANGLES	240 × 90 × 11,5	250 × 90 × 13	270 × 90 × 13	280 × 90 × 12,5	290 × 90 × 14	300 × 95 × 13,5
5,8	BULB ANGLES	250 × 90 × 12,5	270 × 90 × 12,5	280 × 90 × 13	290 × 90 × 15	300 × 95 × 14	280 × 100 × 100 × 12 / 16,5
6,1	BULB ANGLES	280 × 90 × 12	280 × 90 × 13,5	300 × 95 × 13	280 × 100 × 100 × 12 / 16,5	280 × 100 × 100 × 12,5 / 16,5	300 × 100 × 100 × 12 / 17
6,4	BULB ANGLES	280 × 90 × 13,5	300 × 95 × 13	280 × 100 × 100 × 12 / 16,5	280 × 100 × 100 × 13,5 / 16,5	300 × 100 × 100 × 12 / 17	320 × 100 × 100 × 12 / 17,5
6,7	BULB ANGLES	300 × 95 × 13	280 × 100 × 100 × 12 / 16,5	280 × 100 × 100 × 13,5 / 16,5	300 × 100 × 100 × 13 / 17	320 × 100 × 100 × 12 / 17,5	340 × 100 × 100 × 12,5 / 18
7,0	CHANNELS	280 × 100 × 100 × 12 / 16,5	280 × 100 × 100 × 14 / 16,5	300 × 100 × 100 × 13,5 / 17	320 × 100 × 100 × 13 / 17,5	340 × 100 × 100 × 12,5 / 18	340 × 100 × 100 × 15 / 18
7,3	CHANNELS	280 × 100 × 100 × 14 / 16,5	300 × 100 × 100 × 14 / 17	320 × 100 × 100 × 13,5 / 17,5	340 × 100 × 100 × 13,5 / 18	340 × 100 × 100 × 15,5 / 18	
7,6	CHANNELS	300 × 100 × 100 × 13,5 / 17	320 × 100 × 100 × 14 / 17,5	340 × 100 × 100 × 14 / 18	340 × 100 × 100 × 16 / 18		
7,9	CHANNELS	320 × 100 × 100 × 13,5 / 17,5	340 × 100 × 100 × 14,5 / 18	340 × 100 × 100 × 16,5 / 18			
8,25	CHANNELS	340 × 100 × 100 × 14 / 18	340 × 100 × 100 × 17 / 18				

The ends of upper 'tween deck stiffeners marked * may be riveted to boundary bars only (no lug attachments).

BULKHEAD STIFFENERS spaced 760 mm. apart and fitted with LUG ATTACHMENTS at top and bottom in accordance with Table 30.

TABLE 28

(SEE CONTINUATION.)

Overall Length of Stiffener, Including End Attachments.		HEIGHT OF TOP OF BULKHEAD AT MIDDLE LINE ABOVE TOP OF STIFFENER.				
		Metres. 3,65	Metres. 4,25	Metres. 4,9	Metres. 5,5	Metres. 6,1
Metres. 2,45	BULB ANGLES ^	mm. 150 × 70 × 8,5	mm. 150 × 75 × 10,5	mm. 170 × 75 × 8,5	mm. 170 × 75 × 9,5	mm. 180 × 75 × 9
2,75		170 × 75 × 9	180 × 75 × 9	180 × 75 × 10	180 × 75 × 11,5	190 × 75 × 10
3,05		180 × 75 × 10	190 × 75 × 9,5	190 × 75 × 11	200 × 75 × 11	220 × 75 × 10,5
3,35		200 × 75 × 10,5	200 × 75 × 11,5	220 × 75 × 10,5	220 × 75 × 12	220 × 75 × 13
3,65		220 × 75 × 11	220 × 75 × 12,5	220 × 75 × 13	240 × 90 × 11,5	240 × 90 × 12,5
3,95		220 × 75 × 13,5	240 × 90 × 11,5	240 × 90 × 12,5	250 × 90 × 13	270 × 90 × 12
4,25		240 × 90 × 12,5	250 × 90 × 13	270 × 90 × 12	280 × 90 × 12	280 × 90 × 13
4,55		270 × 90 × 11,5	280 × 90 × 12	280 × 90 × 13	290 × 90 × 14	300 × 95 × 13
4,9		280 × 90 × 12,5	280 × 90 × 13	300 × 95 × 13	300 × 95 × 14,5	280 × 100 × 100 × 12 / 16,5
5,2	BULB ANGLES v	290 × 90 × 14,5	300 × 95 × 14	280 × 100 × 100 × 12 / 16,5	280 × 100 × 100 × 14 / 16,5	300 × 100 × 100 × 12 / 17
5,5	CHANNELS ^	280 × 100 × 100 × 12 / 16,5	280 × 100 × 100 × 13 / 16,5	300 × 100 × 100 × 12 / 17	320 × 100 × 100 × 12 / 17,5	320 × 100 × 100 × 12,5 / 17,5
5,8		300 × 100 × 100 × 12 / 17	300 × 100 × 100 × 13 / 17	320 × 100 × 100 × 12 / 17,5	340 × 100 × 100 × 12,5 / 18	340 × 100 × 100 × 13,5 / 18
6,1		320 × 100 × 100 × 12 / 17,5	320 × 100 × 100 × 13 / 17,5	340 × 100 × 100 × 12,5 / 18	340 × 100 × 100 × 15 / 18	340 × 100 × 100 × 16,5 / 18
6,4		340 × 100 × 100 × 12,5 / 18	340 × 100 × 100 × 13,5 / 18	340 × 100 × 100 × 16 / 18		
6,7		340 × 100 × 100 × 15 / 18				
7,0						
7,3						
7,6						
7,9						
8,25	CHANNELS v					

BULKHEAD STIFFENERS spaced 760 mm. apart and fitted with LUG ATTACHMENTS at top and bottom in accordance with Table 30.

TABLE 28

(SEE CONTINUATION.)

Overall Length of Stiffener, Including End Attachments.		HEIGHT OF TOP OF BULKHEAD AT MIDDLE LINE ABOVE TOP OF STIFFENER.				
		Metres. 6,7	Metres. 7,3	Metres. 7,9	Metres. 8,55	Metres. 9,15
Metres. 2,45	^ BULB ANGLES	mm. 180 × 75 × 9,5	mm. 180 × 75 × 10,5	mm. 190 × 75 × 9,5	mm. 190 × 75 × 11	mm. 200 × 75 × 10,5
2,75		200 × 75 × 10,5	200 × 75 × 11	220 × 75 × 10,5	220 × 75 × 11,5	220 × 75 × 12
3,05		220 × 75 × 11,5	220 × 75 × 12,5	220 × 75 × 13	220 × 75 × 14	240 × 90 × 11,5
3,35		220 × 75 × 14	240 × 90 × 11,5	250 × 90 × 12	250 × 90 × 12,5	270 × 90 × 11,5
3,65		250 × 90 × 12,5	270 × 90 × 10	270 × 90 × 11,5	280 × 90 × 12	280 × 90 × 13
3,95		280 × 90 × 12	280 × 90 × 12,5	290 × 90 × 13	290 × 90 × 14	300 × 95 × 13
4,25	v	290 × 90 × 14	300 × 95 × 13	300 × 95 × 14,5	280 × 100 × 100 × 12 / 16,5	280 × 100 × 100 × 12,5 / 16,5
4,55	^ CHANNELS	280 × 100 × 100 × 12 / 16,5	280 × 100 × 100 × 12,5 / 16,5	280 × 100 × 100 × 13,5 / 16,5	300 × 100 × 100 × 12 / 17	300 × 100 × 100 × 13 / 17
4,9		280 × 100 × 100 × 14 / 16,5	300 × 100 × 100 × 12 / 17	320 × 100 × 100 × 12 / 17,5	320 × 100 × 100 × 12,5 / 17,5	340 × 100 × 100 × 12,5 / 18
5,2		320 × 100 × 100 × 12 / 17,5	320 × 100 × 100 × 12,5 / 17,5	340 × 100 × 100 × 12,5 / 18	340 × 100 × 100 × 13,5 / 18	340 × 100 × 100 × 15 / 18
5,5		340 × 100 × 100 × 12,5 / 18	340 × 100 × 100 × 13,5 / 18	340 × 100 × 100 × 15 / 18	340 × 100 × 100 × 16,5 / 18	
5,8		340 × 100 × 100 × 15 / 18				
6,1						
6,4						
6,7						
7,0						
7,3						
7,6						
7,9						
8,25	v					

BULKHEAD STIFFENERS spaced 760 mm. apart and fitted with LUG ATTACHMENTS at top and bottom in accordance with Table 30.

TABLE 28
(CONCLUDED.)

Overall Length of Stiffener, Including End Attachments.		HEIGHT OF TOP OF BULKHEAD AT MIDDLE LINE ABOVE TOP OF STIFFENER.				
		Metres. 9,75	Metres. 10,35	Metres. 10,95	Metres. 11,6	Metres. 12,2
Metres. 2,45	BULB ANGLES	mm. 200 × 75 × 11	mm. 200 × 75 × 12	mm. 220 × 75 × 11	mm. 220 × 75 × 11,5	mm. 220 × 75 × 12
2,75		220 × 75 × 12,5	220 × 75 × 13	220 × 75 × 14	240 × 90 × 11,5	240 × 90 × 12
3,05		240 × 90 × 12	250 × 90 × 12	250 × 90 × 12,5	270 × 90 × 11,5	270 × 90 × 12,5
3,35		270 × 90 × 12,5	280 × 90 × 12	280 × 90 × 12,5	280 × 90 × 13	290 × 90 × 13
3,65		290 × 90 × 13	290 × 90 × 14	300 × 95 × 13	300 × 95 × 14	280 × 100 × 100 × 12 / 16,5
3,95		300 × 95 × 14,5	280 × 100 × 100 × 12 / 16,5	280 × 100 × 100 × 12,5 / 16,5	280 × 100 × 100 × 13 / 16,5	300 × 100 × 100 × 12 / 17
4,25	CHANNELS	280 × 100 × 100 × 14 / 16,5	300 × 100 × 100 × 12 / 17	300 × 100 × 100 × 12,5 / 17	320 × 100 × 100 × 12 / 17,5	340 × 100 × 100 × 12,5 / 18
4,55		320 × 100 × 100 × 12 / 17,5	320 × 100 × 100 × 12,5 / 17,5	340 × 100 × 100 × 12,5 / 18	340 × 100 × 100 × 13 / 18	340 × 100 × 100 × 15 / 18
4,9		340 × 100 × 100 × 13 / 18	340 × 100 × 100 × 15 / 18	340 × 100 × 100 × 15,5 / 18	340 × 100 × 100 × 16 / 18	
5,2		340 × 100 × 100 × 16 / 18				
5,5						
5,8						
6,1						
6,4						
6,7						
7,0						
7,3						
7,6						
7,9						
8,25						

TABLE 29

BULKHEAD STIFFENERS in TUGS.

OVERALL LENGTH OF STIFFENERS INCLUDING END ATTACHMENTS.		STIFFENERS BRACKETED AT ENDS.	STIFFENERS WITHOUT BRACKETS OR LUGS AT ENDS.
Metres.		mm.	mm.
2,15	ANGLES	—	90 × 75 × 7,5
2,45		75 × 75 × 7	100 × 75 × 8
2,75		75 × 75 × 7,5	100 × 75 × 8,5
3,05		90 × 75 × 8	120 × 75 × 8,5
3,35		100 × 75 × 8,5	130 × 75 × 8,5
3,65		120 × 75 × 8	140 × 75 × 8,5
3,95		130 × 75 × 8	150 × 75 × 9,5
4,25		140 × 75 × 8,5	170 × 75 × 9
4,55		150 × 75 × 9,5	170 × 75 × 9,5
4,9		170 × 75 × 9	—

Stiffeners spaced 610 mm. apart on collision bulkhead and 760 mm. apart on other bulkheads.

TABLE 30

ATTACHMENT for STIFFENERS.

TYPE AND DEPTH OF STIFFENER.		BRACKET ATTACHMENTS.			LUG ATTACHMENTS.
		Thickness of Bracket.	Width of Flange.	Number and Size of Rivets in each Arm of Bracket.	Number and Size of Rivets in Lugs.
		mm.	mm.		
Angles		8,5	—	3 of 19 mm. Dia.	2 of 19 mm. Dia.
Bulb Angles under 170 mm.		9	—	3 „ 19 „ „	2 „ 19 „ „
Bulb Angles 170 „		9,5	—	3 „ 19 „ „	2 „ 19 „ „
„ „ 180 and 190 „		10	—	4 „ 19 „ „	3 „ 19 „ „
„ „ 200 „ 220 „		10,5	—	5 „ 19 „ „	3 „ 19 „ „
„ „ 230 „ 240 „	FLANGED	8,5	60	6 „ 19 „ „	4 „ 19 „ „
„ „ 250 „ 270 „		9	65	7 „ 19 „ „	4 „ 19 „ „
„ „ 280 „ 290 „		9,5	70	7 „ 22 „ „	4 „ 22 „ „
„ „ 300 „		10	75	8 „ 22 „ „	5 „ 22 „ „
Channels 280 × 100 × 100 „		10	75	9 „ 22 „ „	6 „ 22 „ „
„ 300 × 100 × 100 „		10	75	10 „ 22 „ „	7 „ 22 „ „
„ 320 × 100 × 100 „		10,5	90	11 „ 22 „ „	7 „ 22 „ „
„ 340 × 100 × 100 „		10,5	90	12 „ 22 „ „	8 „ 22 „ „

LLOYD'S REGISTER OF SHIPPING, LONDON.—16*th June*, 1927.

BULKHEAD PLATING. TABLE 31

STIFFENERS SPACED 760 mm. APART				STIFFENERS SPACED 915 mm. APART.			
Depth at Middle Line from top of Bulkhead to Lower Edge of Plate.	Thickness.	Depth at Middle Line from top of Bulkhead to Lower Edge of Plate.	Thickness.	Depth at Middle Line from top of Bulkhead to Lower Edge of Plate.	Thickness.	Depth at Middle Line from top of Bulkhead to Lower Edge of Plate.	Thickness.
Metres.	mm.	Metres.	mm.	Metres.	mm.	Metres.	mm.
2,45	6,5	10,95	10	2,15	7	10,65	11
3,65	7	12,2	10,5	3,2	7,5	11,75	11,5
4,9	7,5	13,4	11	4,25	8	12,8	12
6,1	8	14,65	11,5	5,35	8,5	13,85	12,5
7,3	8,5	15,85	12	6,4	9	14,95	13
8,55	9	17,05	12,5	7,45	9,5	16	13,5
9,75	9,5	18,3	13	8,55	10	17,05	14
				9,6	10,5	18,15	14,5

TUNNEL STIFFENERS SPACED 910 mm. APART. TABLE 32

Mean Height from Base of Tunnel to Bulkhead Deck.		HEIGHT FROM BASE OF TUNNEL TO TOP OF FLAT SIDE.						
		Metres. 0,9	Metres. 1,2	Metres. 1,5	Metres. 1,85	Metres. 2,15	Metres. 2,45	
Metres.		mm.	mm.	mm.	mm.	mm.	mm.	
3,65	ANGLES	75 × 65 × 6	100 × 75 × 7	120 × 75 × 7,5	130 × 75 × 8,5	140 × 75 × 9	140 × 65 × 8	BULB ANGLES
4,9		90 × 65 × 5,5	100 × 75 × 8	130 × 75 × 8	140 × 75 × 9	140 × 65 × 8	150 × 70 × 8,5	
6,1		90 × 65 × 6,5	120 × 75 × 7,5	140 × 75 × 8,5	150 × 75 × 10	150 × 70 × 8,5	170 × 75 × 8,5	
7,3		100 × 75 × 7,5	130 × 75 × 8	150 × 75 × 8,5	140 × 65 × 9	150 × 70 × 9,5	180 × 75 × 9	
8,55		100 × 75 × 8	130 × 75 × 9	150 × 75 × 10,5	150 × 70 × 8,5	170 × 75 × 9,5	190 × 75 × 9,5	
9,75		120 × 75 × 7,5	140 × 75 × 8,5	140 × 75 × 9	170 × 75 × 8,5	180 × 75 × 9	200 × 75 × 10,5	
10,95		120 × 75 × 8	150 × 75 × 8,5	150 × 75 × 8,5	170 × 75 × 9,5	190 × 75 × 9	200 × 75 × 11,5	
12,2		120 × 75 × 8,5	150 × 75 × 10	150 × 75 × 9	180 × 75 × 9	200 × 75 × 10,5	220 × 75 × 11,5	
13,4		130 × 75 × 8	150 × 75 × 10,5	170 × 75 × 8,5	190 × 75 × 9,5	200 × 75 × 11,5	220 × 75 × 12,5	
14,65		130 × 75 × 9	140 × 65 × 8	170 × 75 × 9	190 × 75 × 10	220 × 75 × 10,5	220 × 75 × 14	
15,85		140 × 75 × 8,5	140 × 65 × 9	180 × 75 × 9	200 × 75 × 10,5	220 × 75 × 12,5	240 × 90 × 12	
17,05		140 × 75 × 9	150 × 75 × 8,5	180 × 75 × 9,5	200 × 75 × 11,5	220 × 75 × 14	250 × 90 × 12	
18,3		150 × 75 × 8,5	150 × 70 × 9	190 × 75 × 9,5	220 × 75 × 10,5	240 × 90 × 11,5	270 × 90 × 11,5	

Angle stiffeners of 150 mm. in depth and all bulb angle stiffeners are to be connected to the inner bottom plating by a lug.

HORIZONTAL GIRDERS in OIL FUEL TANKS. TABLE 33

VALUES OF $S^2 \times D \times H$		GIRDER.		VALUES OF $S^2 \times D \times H$		GIRDER.	
		Intercostal.	Face Bars.			Intercostal.	Face Bars.
		mm.	mm.			mm.	mm.
120	ANGLES	280 × 9,5	130 × 75 × 8,5	890	BULB ANGLES	840 × 10	200 × 75 × 12
155		380 × 9,5	120 × 75 × 7,5	950		840 × 10	220 × 75 × 13,5
190	BULB ANGLES	380 × 9,5	150 × 70 × 8	1025		840 × 10	250 × 90 × 12,5
225		380 × 9,5	150 × 70 × 11	1085		915 × 10,5	220 × 75 × 12,5
260		455 × 9,5	150 × 70 × 9	1155		915 × 10,5	240 × 90 × 12
295		455 × 9,5	170 × 75 × 10,5	1225		915 × 10,5	250 × 90 × 13,5
330		535 × 10	150 × 70 × 9	1295		990 × 11	220 × 75 × 13,5
360		535 × 10	180 × 75 × 9	1365		990 × 11	250 × 90 × 12,5
400		535 × 10	190 × 75 × 10	1455		990 × 11	250 × 90 × 14,5
430		535 × 10	190 × 75 × 11,5	1550		1065 × 11,5	230 × 90 × 13,5
475		610 × 10	180 × 75 × 11	1645		1065 × 11,5	250 × 90 × 14,5
520		610 × 10	190 × 75 × 12	1785		1065 × 11,5	290 × 90 × 15,5
560		685 × 10	180 × 75 × 10	1890		1145 × 12	250 × 90 × 15
605		685 × 10	190 × 75 × 11	2010		1145 × 12	290 × 90 × 15,5
650		685 × 10	200 × 75 × 12,5	2130		1145 × 12	300 × 95 × 15
690		685 × 10	220 × 75 × 12,5	2250		1220 × 12,5	290 × 90 × 14,5
735		760 × 10	200 × 75 × 11	2375		1220 × 12,5	300 × 95 × 15
785		760 × 10	200 × 75 × 13	2495		1220 × 12,5	300 × 95 × 17
840		760 × 10	220 × 75 × 13,5				

VERTICAL STIFFENERS on BOUNDARY BULKHEADS of OIL FUEL BUNKERS and DEEP WATER BALLAST TANKS.

TABLE 34

(SEE CONTINUATION.)

Overall Length of Stiffener including End Attachments.		HEAD H			
		Metres. 0	Metres. 1,2	Metres. 2,45	Metres. 3,65
Metres. 1,5	ANGLES	mm. 75 × 75 × 6	mm. 100 × 75 × 6,5	mm. 130 × 75 × 9	mm. 150 × 75 × 10
1,85		90 × 75 × 7	130 × 75 × 8,5	150 × 75 × 10	170 × 75 × 11
2,15		100 × 75 × 9,5	140 × 75 × 10,5	170 × 75 × 11,5	150 × 70 × 9,5
2,45		130 × 75 × 9	150 × 75 × 9,5	150 × 70 × 9,5	170 × 75 × 11
2,75		140 × 75 × 10,5	150 × 70 × 11	170 × 75 × 11	180 × 75 × 12,5
3,05		150 × 75 × 12,5	170 × 75 × 9	190 × 75 × 10	200 × 75 × 13
3,35	BULB ANGLES	150 × 70 × 10,5	180 × 75 × 11	200 × 75 × 13	220 × 75 × 14
3,65		180 × 75 × 8,5	200 × 75 × 10	220 × 75 × 12,5	250 × 90 × 13
3,95		190 × 75 × 10	220 × 75 × 11	240 × 90 × 12,5	270 × 90 × 15
4,25		200 × 75 × 13	220 × 75 × 15	250 × 90 × 15,5	280 × 90 × 17
4,55		220 × 75 × 14,5	250 × 90 × 14	280 × 90 × 14,5	300 × 95 × 17,5
4,9		240 × 90 × 13	270 × 90 × 15	300 × 95 × 14,5	300 × 100 × 100 × 12/17
5,2		250 × 90 × 15,5	280 × 90 × 16,5	300 × 100 × 100 × 11,5/17	320 × 100 × 100 × 14/17,5
5,5		280 × 90 × 14	300 × 95 × 17	300 × 100 × 100 × 17/17	340 × 100 × 100 × 17/18
5,8		280 × 90 × 16,5	300 × 100 × 100 × 13,5/17	320 × 100 × 100 × 17/17,5	
6,1	CHANNELS	300 × 100 × 100 × 12/17	320 × 100 × 100 × 16,5/17,5		
6,4		300 × 100 × 100 × 16/17	340 × 100 × 100 × 17/18		
6,7		320 × 100 × 100 × 16,5/17,5			
7,0		340 × 100 × 100 × 17,5/18			
7,3					

VERTICAL STIFFENERS on BOUNDARY BULKHEADS of OIL FUEL BUNKERS and DEEP WATER BALLAST TANKS.

TABLE 34 (CONCLUDED.)

Overall Length of Stiffener including End Attachments.		HEAD H			
		Metres. 4,9	Metres. 6,1	Metres. 7,3	Metres. 8,55
Metres. 1,5	ANGLES	mm. 170 × 75 × 10,5	mm. 150 × 70 × 9,5	mm. 150 × 70 × 10,5	mm. 170 × 75 × 9,5
1,85	^ BULB ANGLES	150 × 70 × 9,5	170 × 75 × 10	180 × 75 × 10,5	190 × 75 × 10
2,15		170 × 75 × 10	180 × 75 × 10,5	200 × 75 × 11,5	220 × 75 × 10,5
2,45		190 × 75 × 11	200 × 75 × 11,5	220 × 75 × 11,5	220 × 75 × 14
2,75		220 × 75 × 11	220 × 75 × 13	240 × 90 × 11,5	250 × 90 × 13
3,05		220 × 75 × 14	250 × 90 × 13	270 × 90 × 12,5	280 × 90 × 12,5
3,35		250 × 90 × 13	270 × 90 × 15	280 × 90 × 15	300 × 95 × 14
3,65		270 × 90 × 15	280 × 90 × 17	300 × 95 × 15,5	300 × 100 × 100 × 12/17
3,95		280 × 90 × 16,5	300 × 95 × 17,5	300 × 100 × 100 × 12/17	320 × 100 × 100 × 15/17,5
4,25	v	300 × 95 × 17	300 × 100 × 100 × 12,5/17	320 × 100 × 100 × 15/17,5	340 × 100 × 100 × 16/18
4,55	^ CHANNELS	300 × 100 × 100 × 12/17	320 × 100 × 100 × 15,5/17,5	340 × 100 × 100 × 16/18	
4,9		320 × 100 × 100 × 15/17,5	340 × 100 × 100 × 16,5/18		
5,2		340 × 100 × 100 × 16,5/18			
5,5					
5,8					
6,1					
6,4					
6,7					
7,0					
7,3	v				

NON-WATERTIGHT BULKHEADS. TABLE 35

OVERALL LENGTH OF STIFFENER.		* STIFFENERS TWO FRAME SPACES APART FITTED TO NON-WATERTIGHT MIDDLE LINE BULKHEADS ACTING IN LIEU OF A ROW OF PILLARS.			* STIFFENERS TWO FRAME SPACES APART FITTED TO LONGITUDINAL BUNKER BULKHEADS ACTING IN LIEU OF A ROW OF PILLARS.			* STIFFENERS TWO FRAME SPACES APART FITTED TO LONGITUDINAL BUNKER BULKHEADS NOT ACTING IN LIEU OF A ROW OF PILLARS.	STIFFENERS TO TRANSVERSE BUNKER BULKHEADS SPACED 910 MM. APART.
		Under Upper Deck.	Under Second Deck.	Under Third Deck.	Under Upper Deck.	Under Second Deck.	Under Third Deck.		
Metres.		mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
2,45	ANGLES	130 × 75 × 7,5	140 × 75 × 9	150 × 70 × 8,5	120 × 75 × 8	140 × 75 × 8	150 × 70 × 8	100 × 75 × 8	100 × 75 × 8
3,05	ANGLES	130 × 75 × 8	150 × 75 × 10,5	150 × 70 × 9,5	120 × 75 × 8,5	150 × 75 × 9,5	150 × 70 × 9,5	120 × 75 × 7,5	120 × 75 × 7,5
3,65	ANGLES	130 × 75 × 9	150 × 70 × 9,5	170 × 75 × 9,5	120 × 75 × 9,5	170 × 75 × 10	150 × 70 × 10,5	120 × 75 × 8,5	120 × 75 × 8,5
4,25	ANGLES	140 × 75 × 9	170 × 75 × 10	180 × 75 × 10,5	130 × 75 × 9,5	150 × 70 × 10,5	170 × 75 × 10,5	130 × 75 × 8,5	130 × 75 × 8,5
4,90	BULB ANGLES	150 × 70 × 9	190 × 75 × 10,5	200 × 75 × 12	150 × 75 × 10	180 × 75 × 10	190 × 75 × 11,5	150 × 75 × 9	150 × 75 × 9
5,50	BULB ANGLES	170 × 75 × 10	200 × 75 × 12	220 × 75 × 13,5	150 × 70 × 10,5	190 × 75 × 12	220 × 75 × 11,5	150 × 70 × 9	150 × 70 × 8,5
6,1	BULB ANGLES	180 × 75 × 11	220 × 75 × 13	250 × 90 × 13,5	170 × 75 × 10,5	220 × 75 × 11,5	240 × 90 × 12	170 × 75 × 9,5	150 × 70 × 9,5
6,7	BULB ANGLES	200 × 75 × 11,5	250 × 90 × 12,5	280 × 90 × 13,5	190 × 75 × 10,5	240 × 90 × 11,5	270 × 90 × 12	190 × 75 × 10	170 × 75 × 9,5
7,3	BULB ANGLES	220 × 75 × 12	270 × 90 × 12,5	300 × 95 × 13,5	220 × 75 × 10,5	250 × 90 × 12	280 × 90 × 14	200 × 75 × 10,5	180 × 75 × 10
7,9	BULB ANGLES	240 × 90 × 11,5	290 × 90 × 13		220 × 75 × 12,5	270 × 90 × 13,5	300 × 95 × 13	220 × 75 × 11	190 × 75 × 11
8,55	BULB ANGLES	250 × 90 × 12,5	300 × 95 × 13,5		240 × 90 × 11	280 × 90 × 14		220 × 75 × 12	200 × 75 × 11
9,15	BULB ANGLES	270 × 90 × 12,5			250 × 90 × 11,5	300 × 95 × 14		240 × 90 × 11,5	200 × 75 × 12

* Where frames are spaced not more than 760 mm. apart.

LLOYD'S REGISTER OF SHIPPING, LONDON.—12*th April*, 1923.

HATCH WEBS.

TABLE A.

TABLE 36

(SEE CONTINUATION.)

HATCHWAY BEAMS.

BREADTH OF HATCHWAY.	WITHOUT FORE AND AFTERS. Spacing Centre to Centre.		WITH FORE AND AFTERS. Spacing Centre to Centre.			ANGLES ON EDGES OF WEBS.
	Metres. 1,2	Metres. 1,5	Metres. 1,85	Metres. 2,45	Metres. 3,05	
Metros.	mm.	mm.	mm.	mm.	mm.	mm.
3,05	230 × 11,5 B.P.	255 × 12,5 B.P.	280 × 7,5	305 × 8	355 × 8,5	75 × 75 × 10
3,65	275 × 12,5 B.P.	300 × 12,5 B.P.	305 × 8	355 × 8,5	430 × 9	75 × 75 × 10
4,25	300 × 12,5 B.P.	305 × 8	355 × 8,5	430 × 9	510 × 9,5	75 × 75 × 10,5
4,90	305 × 8	355 × 8,5	405 × 9	480 × 9,5	560 × 9,5	90 × 75 × 10,5
5,50	355 × 8,5	405 × 9	455 × 9	535 × 9,5	635 × 10	100 × 75 × 11
6,10	380 × 8,5	455 × 9	510 × 9,5	610 × 10	710 × 10,5	100 × 75 × 11
6,70	405 × 9	480 × 9	560 × 9,5	660 × 10,5	760 × 11	120 × 75 × 11,5
7,30	430 × 9	510 × 9,5	585 × 10	710 × 10,5	815 × 11	130 × 90 × 11,5
7,90	455 × 9	535 × 9,5	610 × 10	735 × 10,5	865 × 11,5	140 × 90 × 12
8,55	480 × 9,5	560 × 9,5	635 × 10	785 × 11	915 × 12	150 × 90 × 12,5
9,15	510 × 9,5	585 × 10	660 × 10,5	815 × 11	965 × 12	150 × 90 × 13

The depths are measured from the top edge of uppermost mounting to lower edge of lower mounting at the middle of the beam.
The depth at the ends is to be one half of the depth at the middle, but in no case less than 150 mm.
The larger flanges of the mounting angles are to be fitted horizontally.

CENTRE FORE AND AFTERS. †

LENGTH OF FORE AND AFTER.	STEEL BULB PLATE. Spacing of Fore and Afters.			DOUBLE ANGLES ON UPPER EDGE.	WOOD. Spacing of Fore and Afters.					
	Metres. 0,9	Metres. 1,2	Metres. 1,5		Metres. 0,9		Metres. 1,2		Metres. 1,5	
					Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.
Metros.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
1,85	150 × 9	165 × 9,5	180 × 9,5	65 × 65 × 9	140	180	150	180	165	180
2,45	180 × 10,5	205 × 11	230 × 11	65 × 65 × 9,5	165	180	190	180	205	180
3,05	205 × 12,5	240 × 12,5	280 × 12,5	65 × 65 × 10	205	180	215	205	230	230

SIDE FORE AND AFTERS. †

LENGTH OF FORE AND AFTER.	STEEL BULB ANGLE. Spacing of Fore and Afters.			ANGLE ON UPPER EDGE OF BULB ANGLE.	WOOD. Spacing of Fore and Afters.					
	Metres. 0,9	Metres. 1,2	Metres. 1,5		Metres. 0,9		Metres. 1,2		Metres. 1,5	
					Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.
Metros.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
1,85	150 × 70 × 9,5	170 × 85 × 9,5	180 × 85 × 9,5	65 × 65 × 9	140	140	150	150	165	150
2,45	180 × 85 × 10,5	200 × 85 × 11,5	230 × 90 × 11	65 × 65 × 9,5	165	165	190	180	205	180
3,05	200 × 85 × 13,5	240 × 90 × 12,5	280 × 90 × 12,5	65 × 65 × 10	205	180	215	205	230	230

† Depths of fore and afters are measured to under side of covers, and the bulb plate of the centre fore and after is to be extended to the top of the wood covers.

HATCH WEBS.

TABLE B.

TABLE 36 (CONCLUDED.)

HATCHWAY BEAMS.

BREADTH OF HATCHWAY.	WITHOUT FORE AND AFTERS. Spacing Centre to Centre.		WITH FORE AND AFTERS. Spacing Centre to Centre.			ANGLES ON EDGES OF WEBS.
	Metres. 1,2	Metres. 1,5	Metres. 1,85	Metres. 2,45	Metres. 3,05	
Metros.	mm.	mm	mm.	mm.	mm.	mm.
3,05	200 × 10 B.P.	230 × 11 B.P.	240 × 11,5 B.P.	265 × 12,5 B.P.	290 × 13 B.P.	75 × 75 × 10
3,65	230 × 11 B.P.	255 × 12,5 B.P.	280 × 12,5 B.P.	280 × 7,5	330 × 8,5	75 × 75 × 10
4,25	255 × 12,5 B.P.	290 × 12,5 B.P.	280 × 7,5	330 × 8	380 × 8,5	75 × 75 × 10,5
4,90	280 × 7,5	280 × 7,5	305 × 8	380 × 8,5	430 × 9	90 × 75 × 10,5
5,50	280 × 7,5	305 × 8	355 × 8,5	430 × 9	480 × 9,5	100 × 75 × 11
6,10	305 × 8	330 × 8,5	405 × 9	480 × 9,5	535 × 9,5	100 × 75 × 11
6,70	320 × 8	355 × 8,5	430 × 9	510 × 9,5	585 × 10	120 × 75 × 11,5
7,30	330 × 8,5	370 × 8,5	455 × 9	535 × 9,5	635 × 10	130 × 90 × 11,5
7,90	345 × 8,5	380 × 8,5	480 × 9,5	560 × 9,5	660 × 10,5	140 × 90 × 12
8,55	355 × 8,5	405 × 9	510 × 9,5	585 × 10	685 × 10,5	150 × 90 × 12,5
9,15	380 × 8,5	430 × 9	535 × 9,5	610 × 10	710 × 10,5	150 × 90 × 13

The depths are measured from the top edge of uppermost mounting to lower edge of lower mounting at the middle of the beam.
The depth at the ends is to be one half of the depth at the middle, but in no case less than 150 mm.
The larger flanges of the mounting angles are to be fitted horizontally.

CENTRE FORE AND AFTERS. †

LENGTH OF FORE AND AFTER.	STEEL BULB PLATE. Spacing of Fore and Afters.			DOUBLE ANGLES ON UPPER EDGE.	WOOD. Spacing of Fore and Afters.					
	Metres. 0,9	Metres. 1,2	Metres. 1,5		Metres. 0,9		Metres. 1,2		Metres. 1,5	
					Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.
Metros.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
1,85	125 × 8,5	140 × 8,5	150 × 9	65 × 65 × 9	125	180	140	180	150	180
2,45	150 × 9,5	180 × 10	190 × 10,5	65 × 65 × 9,5	150	180	165	180	180	180
3,05	180 × 11	205 × 11,5	230 × 12,5	65 × 65 × 10	180	180	190	180	205	180

SIDE FORE AND AFTERS. †

LENGTH OF FORE AND AFTER.	STEEL BULB ANGLE. Spacing of Fore and Afters.			ANGLE ON UPPER EDGE OF BULB ANGLE.	WOOD. Spacing of Fore and Afters.					
	Metres. 0,9	Metres. 1,2	Metres. 1,5		Metres. 0,9		Metres. 1,2		Metres. 1,5	
					Depth.	Breadth.	Depth.	Breadth.	Depth	Breadth.
Metros.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
1,85	130 × 65 × 8,5	140 × 65 × 9	150 × 70 × 9,5	65 × 65 × 9	125	125	140	125	150	125
2,45	150 × 70 × 10	180 × 75 × 10	190 × 90 × 10,5	65 × 65 × 9,5	150	125	165	150	180	150
3,05	180 × 75 × 11	200 × 85 × 12	230 × 90 × 12,5	65 × 65 × 10	180	150	190	180	205	180

† Depths of fore and afters are measured to under side of covers, and the bulb plate of the centre fore and after is to be extended to the top of the wood covers.

LLOYD'S REGISTER OF SHIPPING, LONDON.—20*th October*, 1932.

EQUIVALENT SECTIONS in ASSOCIATION with PLATING. TABLE 37

ANGLES.	ANGLES.	BULB ANGLES.	CHANNELS.	CHANNELS.
mm.	mm.	mm.	mm.	mm.
$75 \times 75 \times 10$	$90 \times 75 \times 7{,}5$			
$90 \times 75 \times 10$	$100 \times 75 \times 8{,}5$			
$100 \times 75 \times 10{,}5$	$120 \times 75 \times 8$			
$120 \times 75 \times 10$	$130 \times 75 \times 8$			
$130 \times 75 \times 10$	$140 \times 75 \times 8$			
$140 \times 75 \times 10$	$150 \times 75 \times 9$			
$150 \times 75 \times 10{,}5$	$170 \times 75 \times 8{,}5$	$130 \times 75 \times 8$		
$170 \times 75 \times 10$		$140 \times 75 \times 8$		
		$190 \times 75 \times 8{,}5$	$150 \times 75 \times 75 \times \frac{9{,}5}{12}$	
		$200 \times 85 \times 9{,}5$	$150 \times 85 \times 85 \times \frac{9{,}5}{14}$	$165 \times 80 \times 80 \times \frac{9{,}5}{12}$
		$220 \times 85 \times 9{,}5$	$165 \times 80 \times 80 \times \frac{13{,}5}{12}$	$180 \times 80 \times 80 \times \frac{9{,}5}{13}$
		$230 \times 90 \times 10$	$180 \times 80 \times 80 \times \frac{13{,}5}{13}$	
		$240 \times 90 \times 10{,}5$	$190 \times 90 \times 90 \times \frac{12}{16}$	$200 \times 85 \times 85 \times \frac{10{,}5}{14}$
		$250 \times 90 \times 11$	$200 \times 85 \times 85 \times \frac{14}{14}$	
		$270 \times 90 \times 10{,}5$	$220 \times 90 \times 90 \times \frac{11{,}5}{15}$	
		$280 \times 90 \times 10{,}5$	$220 \times 90 \times 90 \times \frac{14{,}5}{15}$	
		$290 \times 90 \times 11{,}5$	$220 \times 95 \times 95 \times \frac{16}{17}$	$240 \times 95 \times 95 \times \frac{13}{15{,}5}$
		$300 \times 95 \times 12$	$260 \times 95 \times 95 \times \frac{13}{16}$	
			$260 \times 95 \times 95 \times \frac{14{,}5}{16}$	$280 \times 100 \times 100 \times \frac{10{,}5}{16{,}5}$
			$280 \times 100 \times 100 \times \frac{14{,}5}{16{,}5}$	

DIAMETERS and SPACING of RIVETS and BREADTHS of BUTT STRAPS, END LAPS and SEAMS. TABLE 38

Thickness of Plates	mm. Not exceeding 9	mm. Above 9 and not exceeding 12,5	mm. Above 12,5 and not exceeding 18,5	mm. Above 18,5 and not exceeding 24	mm. Above 24 and not exceeding 29	mm. Above 29 to 32
Diameter of Rivets	16	19	22	25	28	32
Breadth of Quadruple riveted Butt Straps in mm. ...	—	—	560	635	720	800
Breadth of Treble riveted Butt Straps in mm. ...	—	360	425	485	545	610
Breadth of Double riveted Butt Straps in mm. ...	205	250	285	—	—	—
Breadth of Single riveted Butt Straps in mm. ...	115	135	—	—	—	—
Breadth of Quintuple riveted End Laps in mm. ...	—	—	380	445	510	570
Breadth of Quadruple riveted End Laps in mm. ...	—	—	305	355	405	460
Breadth of Treble riveted End Laps in mm.	150	190	230	265	305	345
Breadth of Double riveted End Laps in mm.	110	125	150	—	—	—
Breadth of Single riveted End Laps in mm.	65	75	—	—	—	—
Breadth of Treble riveted Seams in mm.	—	—	—	215	240	265
Breadth of Double riveted Seams in mm.	95	115	135	150	170	190
Breadth of Single riveted Seams in mm.	55	65	75	—	—	—
MAXIMUM SPACING FROM CENTRE TO CENTRE. — 3½ diam. c. to c. — In End Connections of Shell Plating and all Deck Stringer Plates (except in Quintuple and Quadruple Riveted End Laps)	55	65	80	90	100	110
4 diam. c. to c. — In Seams of Shell Plating (forward and aft); Quadruple Riveted End Laps and Double Butt Straps; End Laps of Deck Plating, Margin Plates, Girders, Tie Plates and Floor Plates; End Laps and Seams of Inner Bottom Plating	65	75	90	100	115	125
4½ diam. c. to c. — In Quintuple Riveted End Laps; in Seams of Deck Plating; in Seams and End Connections of Bulkhead and Tunnel Plating, in Weather Deck Stringer Angles, Margin Plate Angles; Angles connecting Side Stringers to Web Frames, Flange of W.T. Bulkhead Frames to Bulkhead ..	70	85	100	115	—	—
5 diam. c. to c. — In Flat Keel Angles, Vertical Angles connecting Floors and Centre Girder, Flange of W.T. Bulkhead Frames, to Shell, Deck and Inner Bottom, End Connections and Edges of Mast Plates, Floors and Cross Ties in After Peak ..	80	95	110	125	145	160
5½ diam. c. to c. — In side frames whose spacing exceeds 875 mm. .. .. In both Flanges of the Frames connecting Floors to Shell Plating in Vessels Forward of the half Midship Length, in the Shell Flange of Frames in Deep Tanks, Fore Peak Tanks and After Peak Tanks	90	105	125	140	155	175
6 diam. c. to c. — In Beams fitted at alternate Frames; in bottom Frames to shell plating whose spacing exceeds 875 mm. .. .. In side frames whose spacing exceeds 800 mm. but does not exceed 875 mm.	95	115	135	—	—	—
6½ diam. c. to c. — In side frames whose spacing exceeds 725 mm. but does not exceed 800 mm.; in bottom frames to shell plating whose spacing exceeds 800 mm. but does not exceed 875 mm.	100	125	145	165	—	—
7 diam. c. to c. — In side frames whose spacing does not exceed 725 mm.; in bottom frames to shell plating whose spacing does not exceed 800 mm.; in bottom frames to floors; in reversed frames both to floors and to inner bottom, Floors, Keelsons, Beams except where fitted at alternate Frames, Deck and Hold Stringer Angles, Face Angles on Web Frames and Side Stringers, Bulkhead Stiffeners, Longitudinal Angles on continuous Girders, Vertical Angles connecting Floors and Side Girders, top and bottom Hatch Web Angles	115	135	160	180	—	—

RIVETING of END LAPS and SEAMS. TABLE 39

ITEM.	THICKNESS OF PLATES IN MILLIMETRES.											
	Not exceeding 9	Above 9 and not exceeding 9,5	Above 9,5 and not exceeding 10,5	Above 10,5 and not exceeding 12	Above 12 and not exceeding 13,5	Above 13,5 and not exceeding 15	Above 15 and not exceeding 17,5	Above 17,5 and not exceeding 19,5	Above 19,5 and not exceeding 21,5	Above 21,5 and not exceeding 24	Above 24 and not exceeding 26,5	Above 26,5 to 32
a	Double.	Double.	Treble.	Treble.	Treble.	Treble.	Quadruple.	Quadruple.	Quadruple.	Quintuple.	Quintuple.	Quintuple.
b	,,	Treble.	,,	,,	,,	,,	Treble.	,,	,,	Quadruple.	Quadruple.	,,
c	,,	Double.	Double.	,,	,,	,,	,,	Treble.	,,	,,	,,	Quadruple.
d	,,	,,	,,	,,	,,	,,	,,	Quadruple.	,,	,,	,,	
e	,,	,,	,,	Double.	,,	,,	,,	,,	,,	,,	,,	
f	Single.	Single.	Single.	,,	Double.	,,	,,	,,	,,			
g	,,	Double.	Double.	,,	,,	Double.	Double.	Double.	Double.	Double.	Double.	
h	,,	Single.	Single.	Single.	,,	,,	,,	,,	,,	Treble.	Treble.	
i	,,	,,	,,	,,	Single.	Single	Single.	,,	,,			
j	,,	,,	,,	,,	Double.	Double.	Double.	,,	,,			

The diameter of the rivets used for attachments is to be regulated by the greater thickness of the parts to be connected.
Treble riveted double butt straps may be fitted as an alternative to the quintuple riveted end laps required by the Table.

Riveting Requirements for End Laps.

a. End laps of sheer strake, strake below and stringer plates of the upper deck or "long" bridge for half the vessel's length amidships.

End laps of shell plating from keel to upper turn of bilge for half the vessel's length amidships.

End laps of boss plates.

End laps of centre girder plates in double bottoms.

End laps of floor plates and web frames.

b. End laps of flat keel plates for half the vessel's length amidships.

c. End laps of flat keel plates at ends of vessel.

d. End laps of shell plating from upper turn of bilge to strake below sheerstrake.

End laps of shell plating from keel to upper turn of bilge at ends of vessels.

End laps of sheerstrake, strake below and stringer plates of the upper deck at ends of vessel.

End laps of beam stringer plates to 2nd deck and decks or tiers of beams below.

End laps of tie plates.

End laps of margin plates and middle line strake of double bottoms for half the vessel's length amidships.

End laps of vertical keelson plates, rider plates, and foundation plates.

e. End laps of decks for half the vessel's length amidships.

End laps of inner bottom plating for half the vessel's length amidships.

End laps of side girders in double bottoms.

End laps of margin plates and middle line strake of double bottoms at ends of vessel.

f. End laps of deck plates at ends of vessel.

End laps of inner bottom plating at ends of double bottoms.

Riveting Requirements for Seams.

The edge attainments of shell plating, all fore and aft, are to be regulated by the thickness of the plating amidships.

g. Seams of shell plating from keel to upper turn of bilge.

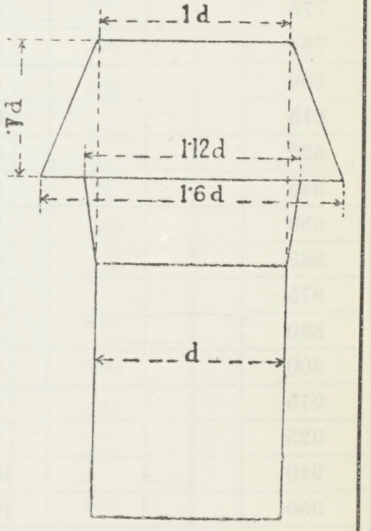
h. Seams of shell plating from upper turn of bilge.

The riveting of seams of shell plating is to be in accordance with **Section 30, clause 5.**

i. Seams of deckplates.

j. Seams of inner bottom plating.

STANDARD FORM OF RIVET.



The tapered neck of Rivet to be of suitable length in relation to the thickness of plate in which it is intended to be used.

Number of RIVETS in SEAMS of PLATING between FRAMES and BEAMS AMIDSHIPS excluding RIVETS in FRAMES and BEAMS. TABLE 40

SPACING OF FRAMES IN MILLIMETRES.	THICKNESS OF SHELL PLATING IN MILLIMETRES.						THICKNESS OF DECK PLATING IN MILLIMETRES.					THICKNESS OF INNER BOTTOM PLATING IN MILLIMETRES.		
	Not exceeding 9	Above 9 and not exceeding 12,5	Above 12,5 and not exceeding 18,5	Above 18,5 and not exceeding 24	Above 24 and not exceeding 29	Above 29 to 32	Not exceeding 9	Above 9 and not exceeding 12,5	Above 12,5 and not exceeding 18,5	Above 18,5 and not exceeding 24	Above 24 to 29	Not exceeding 9	Above 9 and not exceeding 12,5	Above 12,5 and not exceeding 18,5
	Diameter of Rivet in millimetres.						Diameter of Rivet in millimetres.					Diameter of Rivet in millimetres.		
	16	19	22	25	28	32	16	19	22	25	28	16	19	22
	Number of Rivets in each Row.						Number of Rivets in each Row.					Number of Rivets in each Row.		
510	7	6					6	5				7	6	
520	7	6					7	5				7	6	
535	7	6	5				7	5				7	6	5
545		6	5				7	6	5			7	6	5
560		6	5				7	6	5			8	6	5
570		6	5				7	6	5			8	6	5
585		7	6	5			7	6	5			8	7	6
595		7	6	5			8	6	5			8	7	6
610		7	6	5			8	6	5	5		8	7	6
620			6	5				6	5	5		9	7	6
635			6	5	5			7	6	5		9	7	6
645			7	6	5			7	6	5			7	7
660			7	6	5			7	6	5			8	7
675			7	6	5			7	6	5			8	7
685			7	6	5			7	6	5	5		8	7
695			7	6	6			7	6	5	5		8	7
710			7	6	6	5		7	6	5	5		8	7
725			7	6	6	5			6	6	5		8	7
735			8	7	6	5			7	6	5			8
750			8	7	6	5			7	6	5			8
760			8	7	6	5			7	6	5			8
775			8	7	6	5			7	6	5			8
785			8	7	6	5			7	6	5			8
800			8	7	6	6			7	6	6			8
815			8	7	7	6			7	6	6			8
825			8	8	7	6			7	6	6			8
840			9	8	7	6			8	7	6			9
850			9	8	7	6			8	7	6			9
865			9	8	7	6			8	7	6			9
875			9	8	7	6			8	7	6			9
890			9	8	7	6			8	7	6			9
900			9	8	7	6			8	7	6			9
915			9	8	7	6			8	7	6			9
925			9	8	7	6			8	7	6			9
940			10	9	8	7			9	8	7			10
950			10	9	8	7			9	8	7			10
965			10	9	8	7			9	8	7			10
980			10	9	8	7			9	8	7			10
990			10	9	8	7			9	8	7			10

DIAMETERS of RUDDER HEADS. TABLE 41

100 × A × D	SPEED OF VESSEL IN NAUTICAL MILES PER HOUR.					
	12 AND BELOW.	14	16	18	20	22
	DIAMETER OF RUDDER HEAD.					
	mm.	mm.	mm.	mm.	mm.	mm.
80	75	85	90	100	115	125
95	85	90	95	110	120	135
115	90	95	100	115	130	140
135	95	100	110	125	140	150
155	100	110	120	135	145	160
180	110	115	125	140	150	165
205	115	120	135	145	160	170
235	120	125	140	155	170	180
265	125	135	150	165	180	190
295	135	145	160	170	185	195
330	140	150	165	180	190	205
370	145	160	170	185	195	210
410	150	165	180	190	205	220
455	160	170	185	195	210	230
500	165	180	190	205	215	235
545	170	185	195	210	220	245
590	180	190	205	215	230	255
645	185	195	210	220	240	260
700	195	205	220	230	250	265
760	205	215	230	240	255	275
820	215	230	240	255	265	285
950	230	240	255	265	280	300
1105	240	255	265	280	290	315
1260	255	265	280	290	305	330
1430	265	280	290	305	325	350
1615	280	290	305	320	345	370
1815	290	305	320	340	365	390
2040	305	320	330	355	380	405
2265	320	330	345	370	395	420
2520	330	345	355	380	405	435
2775	345	355	370	395	420	450
3060	355	370	390	415	440	465
3340	370	380	405	430	455	480
3655	380	395	420	445	470	495
3965	395	405	430	455	480	510

In Tugs the diameter of the rudder head is to be increased 15 mm. beyond that given in the Table, and all Scantlings of the rudder are to be in accordance with the increased diameter.

LLOYD'S REGISTER OF SHIPPING, LONDON.—*8th April*, 1937.

COUPLINGS of RUDDER HEADS. TABLE 42

DIAMETER OF RUDDER HEAD AS PER TABLE 41.	HORIZONTAL COUPLING. 6 Bolts.		VERTICAL COUPLING. 8 Bolts.		SCARPHED COUPLING.					
					Length of Scarph.	Width of Scarphs.		Bolts.		
								Number.		Diameter.
	Mean Distance of Centres of Bolts from Centre of Coupling.	Diameter of Bolts and Thickness of Flanges.	Width of Coupling.	Diameter of Bolts and Thickness of Flanges.		At Top.	At Bottom.	Total.	In Top Row.	
mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.			mm.
115	115	35	305	35	345	230	380	6	2	38
120	115	35	305	35	345	230	380	6	2	38
125	115	35	305	35	345	230	380	6	2	38
135	120	35	305	35	345	230	380	6	2	38
140	125	35	320	35	355	240	395	6	2	41
145	135	38	330	38	370	255	410	6	2	44
150	140	41	345	41	385	265	425	6	2	48
160	145	44	355	44	400	280	440	6	2	51
165	150	48	370	48	415	290	455	6	2	54
170	160	48	385	48	430	300	475	6	2	54
180	165	51	400	51	445	310	495	6	2	57
185	170	54	415	54	460	325	515	6	2	57
190	180	54	425	54	475	335	535	7	2	54
195	185	57	440	57	495	345	545	7	2	54
205	190	60	455	60	510	355	560	7	2	57
215	195	63	480	63	540	380	610	7	2	63
230	205	70	510	70	570	400	635	7	2	67
240	215	73	540	73	605	425	665	7	2	70
255	230	76	570	76	635	445	700	7	2	73
265	240	79	600	79	665	470	735	8	2	73
280	255	83	630	83	700	490	765	8	2	76
290	265	86	660	86	730	515	800	8	2	79
305	275	89	685	89	760	535	840	8	2	83
320	285	92	710	92	795	635	875	9	3	83
330	300	95	735	95	825	660	915	9	3	83
345	310	98	765	98	855	685	950	9	3	86
355	320	102	795	102	890	710	985	9	3	92
370	330	105	825	105	920	735	1015	9	3	95
380	345	108	850	108	950	760	1040	9	3	98

SINGLE PLATE RUDDERS. TABLE 43

Diameter of Rudder Head as per Table 41.	Diameter of Pintles.	Diameter of Mainpiece at Heel.	ARM AT EACH PINTLE KEYED TO MAINPIECE.						ARM AT AND BETWEEN RUDDER PINTLES.								Diameter of Rivets spaced 4½ Diameters apart Centre to Centre.
			Arm at Mainpiece.		Thickness of Arm round Mainpiece.	Thickness of Arm at Point.	Maximum Distance between Centre of Arms.	Thickness of Plate.	Keyed to Mainpiece.			Forged to Mainpiece.		Thickness of Arm at Point.	Maximum Distance between Centre of Arms.	Thickness of Plate.	
									Arm at Mainpiece.		Thickness of Arm round Mainpiece.	Breadth of Arms.					
			Breadth.	Thickness.					Breadth.	Thickness.		With Small Fillet.	With Large Fillet.				
mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
70	50	55	70	48	32	19	1145	19	70	38	29	125	115	19	660	12,5	22
75	50	65	75	51	35	19	1145	19	75	38	29	125	115	19	660	12,5	22
85	55	70	85	54	35	19	1170	19,5	85	38	29	125	115	19	660	12,5	22
90	55	70	90	57	38	19	1170	19,5	90	41	29	125	115	19	660	13	22
95	65	75	95	60	41	19	1195	20	95	44	32	125	115	19	660	13	25
100	65	75	100	63	44	22	1220	20,5	100	47	35	140	115	22	685	13,5	25
110	70	85	110	67	47	22	1245	20,5	110	47	35	140	115	22	685	13,5	25
115	70	90	115	70	51	22	1270	21	115	51	35	140	115	22	685	14	25
120	70	90	120	73	51	22	1295	21,5	120	54	38	140	115	22	685	14	25
125	75	95	125	76	54	25	1320	22	125	54	38	140	115	25	710	14,5	28
135	75	100	135	79	57	25	1345	22,5	125	57	38	140	115	25	710	14,5	28
140	75	110	140	79	57	25	1370	23	135	57	38	150	125	25	710	15	28
145	75	110	145	83	60	25	1370	23	140	60	41	150	125	25	710	15	28
150	75	115	150	86	60	25	1395	23,5	140	60	41	150	125	25	735	15,5	28
160	85	120	160	86	60	25	1420	24	145	60	41	150	125	25	735	16,5	28
165	85	125	165	89	63	25	1445	24	145	63	44	150	125	25	735	17	28
170	90	125	170	89	63	25	1475	24,5	150	67	47	150	125	25	735	17	28
180	90	135	180	92	63	25	1500	25	150	70	51	150	125	25	760	17,5	28
185	90	140	185	92	67	25	1525	25,5	150	70	51	150	125	25	760	17,5	28
190	95	140	190	95	67	25	1550	25,5	150	73	54	150	125	25	760	18	28
195	95	145	195	98	70	25	1550	25,5	160	76	54	150	125	25	760	18	28
205	100	150	205	102	70	25	1575	26	160	79	57	150	125	25	785	18,5	32
215	110	165	215	108	76	28	1600	26,5	160	83	57	165	140	28	785	18,5	32
230	115	170	230	111	76	28	1600	26,5	160	89	63	165	140	28	815	19	32
240	120	185	240	114	79	28	1625	27	165	98	70	165	140	28	815	19,5	32
255	125	190	255	117	83	28	1650	27,5	165	105	73	165	140	28	840	20	32
265	135	205	265	121	86	28	1675	28	165	108	76	165	140	28	840	20,5	32
280	140	210	280	127	89	28	1700	28	170	111	79	180	150	28	865	21	32
290	145	215	290	133	92	28	1725	28,5	170	114	83	180	150	28	865	21	32
305	150	230	305	137	92	28	1750	28,5	180	117	86	180	150	28	890	21,5	32
320	160	240	320	140	95	28	1780	29	185	121	89	180	150	28	890	21,5	32
330	165	250	330	140	95	28	1805	29	190	124	89	180	150	28	915	22	32
345	170	260	345	143	98	28	1830	29,5	195	127	92	190	165	28	915	22	32
355	170	265	355	143	98	28	1855	29,5	205	130	92	190	165	28	940	22,5	32
370	180	280	370	146	102	28	1880	30	210	133	95	190	165	28	940	22,5	32
380	180	285	380	146	102	28	1905	30	215	137	95	190	165	28	965	23	32

DOUBLE PLATE RUDDERS. TABLE 44

DIAMETER OF RUDDER HEAD AS PER TABLE 41.	DIAMETER OF PINTLES.	SECTION OF MAINPIECE AT HEEL.	MINIMUM DIMENSIONS OF BOW AND STAYS.	THICKNESS OF PLATES.	DIAMETER OF RIVETS SPACED 5 DIAMETERS APART FROM CENTRE TO CENTRE.
mm.	mm.	mm. *	mm.	mm.	mm.
70	50	50 × 45	50 × 22	6	19
75	50	50 × 50	50 × 22	6	19
85	55	55 × 50	55 × 22	6	19
90	55	65 × 50	55 × 22	6,5	19
95	65	65 × 55	65 × 22	6,5	19
100	65	70 × 55	65 × 25	6,5	19
110	70	70 × 65	65 × 25	6,5	19
115	70	75 × 70	65 × 29	7	19
120	70	85 × 70	70 × 29	7	19
125	75	85 × 75	70 × 32	7	22
135	75	90 × 75	70 × 32	7	22
140	75	100 × 75	70 × 35	7,5	22
145	75	110 × 75	75 × 35	7,5	22
150	75	115 × 75	75 × 38	7,5	22
160	85	120 × 85	75 × 38	7,5	22
165	85	125 × 85	75 × 41	8	22
170	90	135 × 90	85 × 41	8	22
180	90	140 × 90	85 × 44	8	22
185	90	150 × 90	90 × 44	8,5	22
190	95	160 × 95	90 × 47	8,5	22

* The figures in this column are to be the fore and aft dimensions.

STEERING CHAINS, RODS, QUADRANTS and TILLERS. TABLE 45

DIAMETER OF RUDDER HEAD AS PER TABLE 41.	RADIUS OF QUADRANT.	Diameter of Chains.	Diameter of Rods.	BOSS OF QUADRANT.		QUADRANTS AND TILLERS.		
				Depth.	Outside Diameter.	Sizes of Arms at Twice the Diameter of Rudder Head from Centre of Rudder Head.		
						One Arm.	Two Arms.	Three Arms.
mm.	mm.	mm	mm.	mm.	mm.	mm.	mm.	mm.
70	865	9,5	12,5	70	135	85 × 47		
75	915	11	12,5	75	140	85 × 50		
85	915	12,5	14,5	85	145	85 × 55		
90	965	14,5	16	90	160	90 × 65		
95	965	14,5	16	95	170	100 × 65		
100	1015	16	17,5	100	185	110 × 65		
110	1015	17,5	19	110	190	115 × 70		
115	1065	17,5	19	115	205	125 × 70	95 × 55	
120	1065	19	20,5	120	215	135 × 70	100 × 55	
125	1115	19	20,5	125	230	140 × 75	110 × 65	
135	1115	20,5	22	135	235	145 × 75	115 × 65	
140	1170	20,5	24	140	250	150 × 85	120 × 65	
145	1170	22	24	145	260	160 × 85	125 × 65	
150	1220	22	25,5	150	275	165 × 90	135 × 70	
160	1220	24	27	160	285	170 × 90	140 × 70	
165	1270	24	27	165	300	180 × 95	140 × 75	
170	1270	25,5	29	170	305	185 × 95	145 × 75	
180	1320	25,5	32	180	320	190 × 100	150 × 85	
185	1320	27	32	185	330	195 × 110	150 × 85	
190	1370	27	33,5	190	345	205 × 115	160 × 90	
195	1370	29	35	195	355	210 × 115	160 × 95	
205	1420	30,5	35	205	370	215 × 120	165 × 100	145 × 90
215	1525	32	38	215	385	230 × 125	180 × 100	150 × 95
230	1625	33,5	40	230	410	240 × 135	190 × 110	165 × 95
240	1725	35	42,5	240	430	255 × 145	205 × 115	180 × 100
255	1830	36,5	44,5	255	455	265 × 150	215 × 115	190 × 100
265	1930	38	47,5	265	480	280 × 160	230 × 120	205 × 100
280	2030	40	49	280	500	290 × 170	240 × 125	210 × 115
290	2235	41,5	51	290	525	305 × 180	255 × 135	215 × 125
305	2440	41,5	51	305	545	320 × 190	265 × 140	230 × 125
320	2440			320	570	330 × 190	280 × 140	240 × 125
330	2440			330	595	345 × 190	285 × 145	255 × 125
345	2440			345	620	355 × 205	290 × 150	255 × 135
355	2440			355	640	370 × 205	305 × 150	265 × 135
370	2440			370	665	380 × 215	310 × 165	265 × 140
380	2440			380	685	395 × 215	325 × 165	280 × 140

BOLTS for BOLTED TILLERS and QUADRANTS. TABLE 46

Diameter of Rudder Head as per Table 41.	ONE BOLT EACH SIDE.		TWO BOLTS EACH SIDE.		FOUR BOLTS EACH SIDE.			Thickness of Coupling.
	Diameter.	Distance Centre to Centre.	Diameter.	Distance Centre to Centre.	Diameter.	Inner Bolts Centre to Centre.	Outer Bolts Centre to Centre.	
mm.	mm.	mm.	mm.	mm.	mm	mm.	mm.	mm.
100	44	305	35	280	22	240	380	38
115	51	330	38	305	25	265	420	41
125	57	355	44	330	29	290	455	44
140	63	380	48	355	32	320	510	47
150	70	420	51	380	35	345	560	50
165	76	455	54	405	38	380	610	50
180	83	480	57	430	41	405	650	55
190	89	520	63	470	44	430	700	55
205	95	560	67	510	48	470	750	65
215	98	585	70	535	51	495	800	65
230	102	610	73	560	54	520	850	70
240			76	595	54	545	875	70
255			83	620	57	570	915	75
265			86	660	60	610	965	75
280			92	685	63	635	1015	75
290			95	725	67	660	1065	75
305			98	750	70	685	1105	85
330			108	815	76	750	1205	85
355			115	875	79	815	1295	85
380			123	940	86	865	1370	85

MASTS of STEAM VESSELS. TABLE 47

LENGTH OF MAST FROM UPPER DECK TO HOUNDS.	DIAMETER AND THICKNESS OF MAST AT PARTNERS.	DIAMETER AND THICKNESS OF MAST AT HOUNDS.	LENGTH OF MAST FROM UPPER DECK TO HOUNDS.	DIAMETER AND THICKNESS OF MAST AT PARTNERS.	DIAMETER AND THICKNESS OF MAST AT HOUNDS.
Metres.	mm.	mm.	Metres.	mm.	mm.
9,15	405 × 7,5	345 × 6,5	17,35	635 × 9,5	520 × 8,5
10,05	430 × 7,5	355 × 6,5	18,3	660 × 10	535 × 9
10,95	455 × 8	370 × 7	19,2	685 × 10,5	560 × 9
11,9	485 × 8	380 × 7	20,1	710 × 11	585 × 9,5
12,8	510 × 8,5	405 × 7,5	21,05	735 × 11,5	610 × 9,5
13,7	535 × 8,5	430 × 7,5	21,95	760 × 12	635 × 10
14,65	560 × 9	455 × 8	22,85	785 × 12,5	660 × 10
15,55	585 × 9	485 × 8	23,75	815 × 12,5	685 × 10
16,45	610 × 9,5	510 × 8,5	24,7	840 × 12,5	710 × 10

STAYS to MASTS of STEAMERS. TABLE 48

LENGTH OF MAST FROM UPPER DECK TO HOUNDS.	SHROUDS TO EACH SIDE OF MAST.		TOP MAST BACK STAY.		FORE TOP MAST STAY.		FORE STAY.
	Number.	Size.	Number.	Size.	Number.	Size.	
Metres.		mm.		mm.		mm.	mm.
9,15	2	65	1	40	—	—	70
10,05	2	70	1	45	—	—	75
10,95	2	75	1	50	—	—	75
11,9	3	75	1	55	1	55	85
12,8	3	85	1	65	1	65	85
13,7	3	90	1	70	1	70	90
14,65	3	90	1	75	1	75	90
15,55	3	95	1	75	1	75	90
16,45	3	100	1	75	1	75	100
17,35	3	100	1	75	1	75	100
18,3	3	110	1	75	1	75	100
19,2	3	115	1	75	1	75	110
20,1	3	120	1	75	1	75	110
21,05	3	125	2	75	2	75	110
21,95	3	125	2	75	2	75	115
22,85	4	115	2	75	2	75	115
23,75	4	120	2	75	2	75	115
24,7	4	125	2	75	2	75	115

MASTS of SAILING VESSELS. TABLE 49

LENGTH OF MAST.		DIAMETER AND THICKNESS OF MAST.								SIZES OF ANGLE BARS IN MASTS.	CHEEKS.	
		Partners.		Heel.		Hounds.		Head.			Thickness of Plate.	Sizes of Angle Bars.
Fore and aft Rig.	Square Rig.											
Metres.	Metres.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
10,95	9,15	405	7,5	330	6,5	345	6,5	280	6		10	90 × 65 × 8,5
11,6	9,45	430	7,5	345	6,5	355	6,5	290	6		10	90 × 75 × 9
12,5	10,05	455	7,5	355	6,5	380	6,5	305	6,5		10	90 × 75 × 9
13,4	10,65	485	8,5	380	7,5	395	7,5	320	6,5		11	100 × 75 × 10
14,3	11,3	510	8,5	405	7,5	420	7,5	345	7,5		11	100 × 75 × 10
15,25	11,9	535	8,5	420	7,5	445	7,5	355	7,5		11	100 × 75 × 10
16,15	12,5	560	9	430	7,5	470	7,5	370	7,5		11,5	120 × 75 × 10
17,05	13,1	585	9	455	7,5	485	7,5	395	7,5		11,5	120 × 75 × 11
18,3	13,7	610	9	485	7,5	510	7,5	405	7,5		11,5	120 × 75 × 11
19,5	14,65	635	10	495	8,5	535	8,5	420	8,5		12,5	130 × 75 × 11,5
20,7	15,25	660	10	510	8,5	545	8,5	445	8,5		12,5	130 × 75 × 12,5
22,0	16,15	685	11	535	8,5	570	8,5	455	8,5		12,5	130 × 90 × 12,5
23,5	16,75	710	11	560	9	585	9	470	9	90 × 75 × 10	13,5	130 × 90 × 12,5
25,0	17,70	735	11,5	570	9	610	9	495	9	100 × 75 × 10,5	13,5	150 × 100 × 13
	18,3	760	11,5	585	10	635	10	510	9	100 × 75 × 11,5	14	150 × 100 × 14
	19,2	785	12,5	610	10	660	10	520	9	120 × 75 × 11	15	150 × 100 × 14,5
	19,8	815	12,5	635	10	675	10	535	9	130 × 75 × 11,5	15	150 × 100 × 14,5
	20,7	840	12,5	660	10	685	10	545	9	130 × 75 × 12	15	150 × 100 × 14,5

STEEL BOWSPRITS.

LENGTH OUTSIDE BED.	BED.		HEEL.		CAP.		SIZES OF ANGLE BARS.	LENGTH OUTSIDE BED.	BED.		HEEL.		CAP.		SIZES OF ANGLE BARS.
	Diameter.	Thickness.	Diameter.	Thickness.	Diameter.	Thickness.			Diameter.	Thickness.	Diameter.	Thickness.	Diameter.	Thickness.	
Metres.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	Metres.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
4,25	420	7,5	355	7,5	305		65 × 50 × 7,5	6,40	650	10	535	9	445	8	90 × 75 × 9
4,55	445	7,5	380	7,5	320	7,5	65 × 50 × 7,5	6,70	675	10	560	9	470	8	100 × 75 × 10
4,90	480	7,5	405	7,5	330	7,5	75 × 50 × 7,5	7	710	11	585	10	485	8,5	100 × 90 × 10
5,20	510	8,5	430	8,5	355	7,5	75 × 50 × 7,5	7,30	735	11	610	10	510	8,5	100 × 90 × 10
5,50	545	9	455	8,5	380	7,5	75 × 65 × 7,5	7,60	760	11,5	635	10	535	9	120 × 90 × 10,5
5,80	585	9	485	8,5	405	7,5	75 × 75 × 8	7,90	800	11,5	660	10	545	9	120 × 90 × 11
6,10	620	10	510	9	420	8	90 × 75 × 8,5	8,25	840	11,5	685	10	560	9	120 × 90 × 11,5

YARDS and TOPMASTS of SAILING VESSELS. TABLE 50

YARDS.											TOPMASTS.						
Length Cleated.	Centre.		First Quarter.		Second Quarter.		Third Quarter.		Ends at Cleats.		Length.	Heel.		Lower part of Head.		Head.	
	Diameter.	Thickness.	Diameter.	Thickness.	Diameter.	Thickness.	Diameter.	Thickness.	Diameter.	Thickness.		Diameter.	Thickness.	Diameter.	Thickness.	Diameter.	Thickness.
Metres.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	Metres.	mm.	mm.	mm.	mm.	mm.	mm.
9,75	205	4,5	200	4,5	185	4,5	150	4,5	100	3	3,65	305	6	265	6	230	4,5
10,95	230	4,5	220	4,5	205	4,5	170	4,5	115	3	4,10	320	6	280	6	240	4,5
12,20	255	5	250	5	230	4,5	190	4,5	125	3	4,55	330	6	290	6	255	4,5
13,4	280	5,5	275	5,5	255	4,5	210	4,5	140	3	5,05	355	6,5	320	6	265	5
14,65	305	6	300	6	275	5	230	4,5	150	3,5	5,5	370	6,5	330	6	280	5,5
15,85	330	6	320	6	300	5,5	245	4,5	165	3,5	5,95	380	7,5	345	6,5	290	6
17,05	355	6,5	345	6,5	320	6	265	5	180	4	6,40	405	7,5	355	6,5	305	6
18,3	380	6,5	370	6,5	345	6,5	285	5,5	190	4	6,85	420	7,5	370	6,5	320	6,5
19,5	405	7,5	395	7,5	365	7,5	305	6	205	4,5	7,30	430	8,5	380	7,5	330	7,5
20,75	430	7,5	420	7,5	385	7,5	325	6	215	4,5	7,80	455	8,5	405	7,5	345	7,5
21,95	455	7,5	445	7,5	415	7,5	345	6,5	230	4,5	8,25	470	8,5	420	7,5	355	7,5
23,15	480	8	470	7,5	435	7,5	360	6,5	240	5	8,70	480	8,5	430	7,5	370	7,5
24,4	510	9	495	7,5	455	7,5	380	6,5	255	5,5	9,15	510	8,5	455	7,5	380	7,5
25,6	535	10	520	8,5	485	7,5	400	7,5	265	6	9,60	520	8,5	470	7,5	395	7,5
26,8	560	10	545	8,5	500	7,5	420	7,5	280	6	10,05	535	9	485	7,5	405	7,5
28,05	585	10	570	9	525	8,5	440	7,5	290	6,5	10,65	560	9	510	7,5	420	7,5
29,25	610	10	595	9	550	8,5	455	7,5	305	6,5	11,30	585	9	535	7,5	430	7,5

STANDING RIGGING of SAILING VESSELS.

TABLE 51
(SEE CONTINUATION.)

SECOND LONGITUDINAL NUMERAL L × (B + D).	575	660	745	835	930	1060	1190	1320
	No. Size mm.	No. Size mm.	No. Size. mm.	No. Size. mm.	No. Size. mm.	No. Size. mm.	No. Size. mm.	No. Size. mm.
FORE and MAIN Shrouds	4 of 65	4 of 70	5 of 75	5 of 85 and cap	5 of 90 and cap	5 of 95 and cap	6 of 100 and cap	6 of 105 and cap
„ „ Chain plates	32	32	35	41	44	44	48	48
„ „ Dead-eyes	180 × 115	190 × 115	205 × 125	215 × 125	230 × 140	240 × 140	255 × 150	265 × 150
„ „ Lanyards (hemp)	90	95	100	110	115	120	125	135
„ „ Rigging screws, diameter at bottom of thread	29	29	32	35	38	38	41	41
„ „ Rigging screws, diameter of pins... ...	25	25	29	32	35	35	35	35
„ „ Topmast backstays	2 of 65	2 of 70	2 of 75	2 of 85	2 of 90	2 of 95	3 of 100	3 of 105
„ „ Top-gallant backstays	44	51	54	57	60	2 „ 63	2 „ 67	2 „ 70
„ „ Lower stays	2 of 65	2 of 70	2 of 75	2 of 85	2 of 90	2 „ 95	2 „ 100	2 „ 105
„ „ Topmast stays	65	70	75	85	2 „ 90	2 „ 95	2 „ 100	2 „ 105
„ „ Top-gallant stays	44	51	54	57	60	63	67	70
MIZZEN Shrouds	3 of 57	3 of 60	4 of 63	4 of 67	5 of 70	5 of 73	5 of 75	5 of 85 and cap
„ Topmast backstays...	57	60	63	2 „ 67	2 „ 70	2 „ 73	3 „ 75	3 „ 85
„ Top-gallant backstays	32	35	38	41	44	48	2 „ 51	2 „ 54
„ Lower stays...	57	60	63	67	70	73	2 „ 75	2 „ 85
„ Topmast stays	57	60	63	67	70	73	75	2 „ 85
„ Top-gallant stays	32	35	38	41	44	48	51	54
BOBSTAY Bar	50	50	50	50	55	65	75	85
„ Pin	38	38	38	38	41	48	54	57
„ Chain	30	32	32	32	33	35	38	41
BOWSPRIT Shrouds (chain)	14	14	16	17	19	2 of 19	2 of 20	2 of 22

STANDING RIGGING of SAILING VESSELS. TABLE 51

(CONCLUDED.)

SECOND LONGITUDINAL NUMERAL. L × (B + D).	1450	1580	1710	1860	2035	2250	2525
	No. Size. mm.	No. Size. mm.	No. Size mm.	No. Size. mm.	No. Size mm.	No. Size. mm.	No. Size. mm.
FORE and MAIN Shrouds	6 of 110 and cap	6 of 115 and cap	6 of 120 and cap	6 of 125 and cap	6 of 125 and cap	6 of 135 and cap	6 of 140 and cap
„ „ Chain plates	51	54	57	60	63	67	70
„ „ Dead-eyes	280 × 150	290 × 165	305 × 180	—	—	—	—
„ „ Lanyards (hemp)	140	145	150	—	—	—	—
„ „ Rigging screws, diameter at bottom of thread	44	44	48	48	51	54	57
„ „ Rigging screws, diameter of pins	38	38	41	41	44	48	51
„ „ Topmast backstays	3 of 110	3 of 115	3 of 120	3 of 125	3 of 125	3 of 135	3 of 140
„ „ Top-gallant backstays	2 „ 76	2 „ 83	2 „ 90	2 „ 95	2 „ 98	2 „ 105	2 „ 110
„ „ Lower stays	2 „ 110	2 „ 115	2 „ 120	2 „ 125	2 „ 125	2 „ 135	2 „ 140
„ „ Topmast stays	2 „ 110	2 „ 115	2 „ 120	2 „ 125	2 „ 125	2 „ 135	2 „ 140
„ „ Top-gallant stays	75	85	90	95	100	105	110
MIZZEN Shrouds	5 of 90 and cap	5 of 95 and cap	5 of 100 and cap	5 of 105 and cap	5 of 110 and cap	5 of 110 and cap	5 of 115 and cap
„ Topmast backstays	3 „ 90	3 „ 95	3 „ 100	3 „ 105	3 „ 110	3 „ 110	3 „ 115
„ Top-gallant backstays...	2 „ 57	2 „ 63	2 „ 70	2 „ 73	2 „ 76	2 „ 79	2 „ 83
„ Lower stays	2 „ 90	2 „ 95	2 „ 100	2 „ 105	2 „ 110	2 „ 110	2 „ 115
„ Topmast stays	2 „ 90	2 „ 95	2 „ 100	2 „ 105	2 „ 110	2 „ 110	2 „ 115
„ Top-gallant stays	57	63	70	73	76	79	83
BOBSTAY Bar	90	95	95	100	100	105	105
„ Pin	63	67	70	73	76	79	79
„ Chain	44	46	48	49	51	52	52
BOWSPRIT Shrouds (chain)	2 of 22	2 of 25	2 of 25	2 of 27	2 of 27	2 of 29	2 of 29

ANCHOR CRANES. TABLE 52

WEIGHT OF ANCHOR INCLUDING STOCK.	OUTREACH OF CRANE.							
	Metres. 2,75	Metres. 3,05	Metres. 3,35	Metres. 3,65	Metres. 3,95	Metres. 4,25	Metres. 4,55	Metres. 4,9
	DIAMETER OF MAIN POST AT DECK.							
Kilogrammes.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
1015	150	160	165	170	175	180	185	190
1270	165	175	180	185	185	190	195	205
1525	180	185	190	195	195	205	210	215
1780	185	190	195	200	205	210	215	220
2030	190	195	205	210	215	220	230	235
2285	205	210	215	220	230	235	240	250
2540	210	215	220	230	235	240	250	255
2795	215	220	230	235	240	250	255	260
3050	220	230	235	240	250	255	260	265

CORRESPONDING DIMENSIONS OF MAIN POST, TIE RODS AND JIBS.

	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
Diameter of Main Post at Deck ...	150	165	180	190	205	215	230	240	255	265	280
Tie Rod	44	48	51	54	57	60	63	67	70	73	76
Jib (Diameter at Middle)	75	80	90	95	100	110	115	120	125	135	140

Where two tie rods are fitted the diameter of each is to be three-quarters that of the single rod required.

TABLE OF EQUIVALENT SIZES.

DIAMETER IN INCHES AT DECK OF SOLID WROUGHT IRON DAVITS OR OF MAIN POSTS OF ANCHOR CRANES.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
	75	80	90	95	100	110	115	120	125	135	140	145	150	160	165	170	180	185	190	195	205	210	215
DIAMETER AND THICKNESS IN INCHES OF APPROVED WELDLESS DRAWN STEEL HOLLOW BOAT OR ANCHOR DAVITS.	100 × 6,5	110 × 6,5	120 × 6,5	135 × 6,5	135 × 8	145 × 8	155 × 8	165 × 8	165 × 9,5	175 × 9,5	185 × 9,5	195 × 9,5	195 × 11	205 × 11	215 × 11	230 × 11	230 × 12,5	240 × 12,5	250 × 12,5	260 × 12,5	260 × 14,5	270 × 14,5	280 × 14,5

ANCHORS and CHAINS for STEAM VESSELS.

TABLE 53
(SEE CONTINUATION.)

*EQUIPMENT NUMBER.	Letters for Equipment as inserted in Register Book, Column 7.	ANCHORS. Number.		Bower Anchors. Ex Stock.			Bower Anchors. Stockless.			Stream Anchors.* Ex Stock.		CHAIN CABLES. Stud Chain Cables.				
		Bowers.	Stream.	Weight.	Test.	Collective Weight.	Weight.	Test.	Collective Weight.	Stream.	Test.	Length.	Minimum Size.	Proved to Statutory Test.	Breaking Test	Minimum Weight.
				Kilogs.	Kilogs.	Kilogs.	Kilogs.	Kilogs.	Kilogs.	Kilogs.	Kilogs.	Metres.	mm.	Kilogs.	Kilogs.	Kilogs.
280	*a*	2	1	180	6030	355	230	6960	445	40	—	220	17,5	8670	13010	1480
335	*b*	2	1	215	6690	430	265	7650	535	65	3730	220	19	10240	15290	1740
390	*c*	2	1	255	7490	510	320	8670	635	90	4280	250	20,5	11900	17840	2320
445	*d*	2	1	290	8090	585	370	9630	725	115	4830	300	22	13700	20550	3170
500	*e*	2	1	330	8890	660	420	10540	825	140	5340	300	23,5	15640	23460	3660
555	*f*	2	1	370	9630	735	460	11330	915	150	5550	300	25	17720	26570	4110
620	*g*	3	1	420	10540	1195	520	12380	1485	180	6030	300	27	20640	30920	4810
685	*h*	3	1	510	12230	1450	635	14530	1805	205	6480	355	28,5	23010	34510	6350
750	*i*	3	1	595	13780	1700	735	16290	2120	215	6690	355	30	25520	38210	7040
825	*j*	3	1	685	15380	1955	850	18270	2440	240	7200	385	31,5	28130	42110	8420
900	*k*	3	1	775	16980	2210	965	20160	2755	265	7650	385	33	30860	46300	9230
985	*l*	3	1	865	18560	2465	1080	22150	3075	290	8090	385	35	34700	52050	10370
1075	*m*	3	1	950	19930	2720	1180	23660	3390	305	8380	385	36,5	37690	56480	11320
1180	*n*	3	1	1040	21470	2970	1295	25540	3710	330	8890	385	38	40940	59350	12220
1290	*o*	3	1	1145	23140	3250	1425	27560	4065	355	9390	440	39,5	44160	61770	15060
1410	*p*	3	1	1245	24690	3530	1550	29460	4420	395	10080	440	41	47630	66700	16150
1550	*q*	3	1	1345	26400	3810	1675	31320	4775	430	10740	440	42,5	51200	71700	17260
1720	*r*	3	1	1450	27970	4115	1805	33280	5130	470	11480	440	44	54880	76800	18550
1915	*s*	3	1	1575	29820	4470	1970	35520	5590	510	12130	440	46	59970	83940	20150
2110	*t*	3	1	1700	31720	4850	2135	37790	6070	560	13080	440	47,5	63940	89470	21540
2320	*u*	3	1	1830	33640	5235	2285	39870	6500	610	14080	495	49	68000	95200	25620
2535	*v*	3	1	1980	35650	5640	2475	42190	7060	660	14980	495	50,5	72300	101230	27100
2760	*w*	3	1	2135	37790	6070	2665	44580	7595	710	15830	495	52	76580	107200	28810
2990	*x*	3	1	2285	39870	6500	2860	46910	8130	760	16730	495	54	82640	115600	30940
3235	*y*	3	1	2440	41770	6935	3050	49160	8660	825	17820	495	55,5	87330	122180	32800
3495	*z*	3	1	2590	43680	7390	3240	51170	9245	890	18910	495	57	92090	128800	34460
3755	*a*†	3	1	2770	45800	7900	3455	53440	9880	965	20160	495	58,5	97000	135800	36400
4015	*b*†	3	1	2945	47980	8410	3685	55900	10515	1040	21470	550	60	102000	142800	42560
4275	*c*†	3	1	3125	49940	8915	3910	58140	11150	1120	22750	550	62	108900	152500	45470
4535	*d*†	3	1	3300	51800	9425	4130	60060	11785	1195	23900	550	63,5	114300	160000	47760
4795	*e*†	3	1	3480	53760	9930	4345	62260	12420	1270	25140	550	65	118200	165500	50100
5070	*f*†	3	1	3655	55600	10460	4570	64250	13080	1345	26400	550	66,5	122200	171100	52580
5350	*g*†	3	1	3860	57640	11020	4825	66380	13770	1425	27560	605	68	126100	176600	60500
5630	*h*†	3	1	4065	59440	11580	5080	68330	14480	1500	28710	605	69,5	130400	182400	63470
5925	*i*†	3	1	4240	61200	12090	5310	70060	15140	1575	29820	605	71	133800	187400	66200
6225	*j*†	3	1	4420	62850	12600	5535	71720	15800	1650	30970	605	73	139700	195600	70000
6520	*k*†	3	1	4620	64600	13150	5765	73440	16460	1730	32130	605	74,5	143600	201000	73060
6820	*l*†	3	1	4800	66180	13660	5995	75200	17070	1805	33280	605	76	147300	206300	76000
7135	*m*†	3	1	4980	67580	14170	6225	76710	17730	1895	34460	605	77,5	151100	211500	79200
7450	*n*†	3	1	5155	68880	14730	6450	78120	18390	1980	35650	605	79	154800	216600	82200
7785	*o*†	3	1	5360	70410	15290	6705	79740	19100	2070	36880	605	81	160400	224500	86400
8140	*p*†	3	1	5560	71920	15850	6960	81330	19810	2160	38100	605	82,5	164100	229800	89840
8510	*q*†	3	1	5765	73440	16460	7215	82910	20530	2250	39390	605	84	167500	234400	93000
8900	*r*†	3	1	5995	75200	17070	7495	84630	21340	2335	40460	605	85,5	171000	239300	96700
9310	*s*†	3	1	6225	76710	17730	7775	86370	22150	2425	41590	605	87	174300	243900	100100
9755	*t*†	3	1	6450	78120	18390	8075	87860	22960	2515	42720	605	89	179600	251400	104900

* Where the equipment number lies between any two consecutive numbers given in the Table the equipment is to be governed by the greater.

ANCHORS and CHAINS for STEAM VESSELS.

TABLE 53
(CONCLUDED.)

*Equipment Number	Letters for Equipment as inserted in Register Book, Column 7.	Stream Chain or Steel Wire. Length	Chain. Size	Chain. Minimum Weight. Stud Link.	Chain. Minimum Weight. Short Link.	Steel Wire. Size	Steel Wire. Breaking Test	Towline, Hemp or Steel Wire. Length	Towline. Hemp. Size	Towline. Steel Wire. Size	Towline. Steel Wire. Breaking Test	Hawsers and Warps. Hemp or Steel Wire. Length of Each	Hawsers. Number	Hawsers. Hemp. Size	Hawsers. Flexible Steel Wire Rope. Size. (b)	Warps. Number	Warps. Hemp. Size	Warps. Fl'xible Steel Wire Rope, Size. (b)
		Metres.	mm.	Kilogs.	Kilogs.	mm.	Kilogs.	Metres.	mm.	mm.	Kilogs.	Metres.		mm.	mm.		mm.	mm.
280	*a*	85	13	350	390	—	—	135	140	51	8430	165	1	76	—	—	—	—
335	*b*	85	14,5	405	440	51	8430	135	152	57	10970	165	1	102	—	—	—	—
390	*c*	85	14,5	405	440	51	8430	135	152	57	10970	165	1	102	—	—	—	—
445	*d*	85	16	490	545	57	10970	135	165	57	10970	165	1	102	—	—	—	—
500	*e*	85	16	490	545	57	10970	135	178	64	13410	165	1	127	44	—	—	—
555	*f*	85	17,5	580	630	64	13410	135	190	64	13410	165	1	140	51	—	—	—
620	*g*	110	17,5	745	810	64	13410	135	190	64	13410	165	1	140	51	—	—	—
685	*h*	110	19	870	960	70	15450	135	203	70	15450	165	1	152	57	—	—	—
750	*i*	110	20,5	1020	1110	76	18900	135	216	70	15450	165	1	152	57	—	—	—
825	*j*	110	20,5	1020	1110	76	18900	135	216	70	15450	165	1	152	57	1	102	—
900	*k*	110	22	1160	1270	83	22050	165	229	76	18900	165	1	152	57	1	127	44
985	*l*	110	22	1160	1270	83	22050	165	229	76	18900	165	1	152	57	1	127	44
1075	*m*	110	23,5	1340	1470	89	26110	165	—	83	22050	165	1	152	57	1	127	44
1180	*n*	135	23,5	1650	1780	89	26110	165	—	83	22050	165	1	152	57	1	127	44
1290	*o*	135	25	1850	2010	95	29770	165	—	83	22050	165	1	152	57	1	127	44
1410	*p*	135	25	1850	2010	95	29770	165	—	83	22050	165	2	152	57	2	127	44
1550	*q*	135	27	2160	2320	102	33730	165	—	89	26110	165	2	152	57	2	127	44
1720	*r*	135	27	2160	2320	102	33730	165	—	89	26110	165	2	152	57	2	127	44
1915	*s*	135	28,5	2420	2590	108	36800	165	—	102	33730	165	2	178	64	2	152	57
2110	*t*	135	28,5	2420	2590	108	36800	185	—	102	33730	165	2	178	64	2	152	57
2320	*u*	165	28,5	2950	3150	108	36800	185	—	102	33730	165	2	178	64	2	152	57
2535	*v*	165	30	3270	3490	114	44000	220	—	102	33730	165	2	178	64	2	178	64
2760	*w*	165	30	3270	3490	114	44000	220	—	114	44000	165	2	178	64	2	178	64
2990	*x*	165	30	3270	3490	114	44000	220	—	114	44000	165	2	178	64	2	178	64
3235	*y*	165	31,5	3600	3850	121	47750	220	—	121	47750	165	2	203	70	2	178	64
3495	*z*	165	31,5	3600	3850	121	47750	220	—	127	53640	165	2	203	70	2	178	64
3755	*a*†	165	33	3950	4230	127	53640	220	—	121	65640	165	2	203	70	2	178	64
4015	*b*†	220	33	5270	5640	127	53640	240	—	127	72040	185	2	203	70	2	203	70
4275	*c*†	220	33	5270	5640	127	53640	240	—	133	78760	185	2	203	70	2	203	70
4535	*d*†	220	35	5920	6330	121	65640	240	—	140	85750	185	2	203	70	2	203	70
4795	*e*†	220	35	5920	6330	121	65640	240	—	140	85750	185	2	203	70	2	203	70
5070	*f*†	220	36,5	6440	6880	127	72040	240	—	140	85750	185	2	203	70	2	203	70
5350	*g*†	220	38	6620	7420	140	85750	240	—	165	114100	185	2	203	70	2	203	70
5630	*h*†	220	38	6980	7420	140	85750	240	—	165	114100	220	2	203	70	2	203	70
5930	*i*†	220	39,5	7510	8000	140	85750	240	—	165	114100	220	2	203	70	2	203	70
6225	*j*†	220	41	8070	8620	140	85750	240	—	165	114100	220	2	203	70	2	203	70
6520	*k*†	275	42,5	10840	11600	152	100700	255	—	178	132800	220	3	203	70	2	203	70
6820	*l*†	275	44	11590	12460	152	100700	255	—	178	132800	220	3	203	70	2	203	70
7135	*m*†	275	46	12590	13680	152	100700	255	—	178	132800	220	3	203	70	2	203	70
7450	*n*†	275	46	12590	13680	152	100700	255	—	178	132800	220	3	203	70	3	203	70
7785	*o*†	275	47,5	13470	14600	165	114100	255	—	178	132800	220	3	203	70	3	203	70
8140	*p*†	275	47,5	13470	14600	165	114100	255	—	178	132800	220	3	203	70	3	203	70
8510	*q*†	275	49	14230	15600	165	114100	275	—	203	151200	220	3	203	70	3	203	70
8900	*r*†	275	49	14230	15600	165	114100	275	—	203	151200	220	3	203	70	3	203	70
9310	*s*†	275	50,5	15080	16630	178	132800	275	—	203	151200	220	3	203	70	3	203	70
9755	*t*†	275	50,5	15080	16630	178	132800	275	—	203	151200	220	3	203	70	3	203	70

* Where the equipment number lies between any two consecutive numbers given in the Table the equipment is to be governed by the greater.

(*b*) 6 × 12 Flexible Steel Wire Ropes. (*c*) 6 × 24 Special Flexible Steel Wire Ropes. (*d*) 6 × 30 Special Flexible Steel Wire Ropes.

ANCHORS and CHAINS for SAILING VESSELS.

TABLE 54
(SEE CONTINUATION.)

*EQUIPMENT NUMBER.	Letters for Equipment as inserted in Register Book, Column 8	ANCHORS.									CHAIN CABLES.				
		Number.			Bower Anchors. Ex Stock.			Stream and Kedge Anchors. Ex Stock.				Stud Chain Cables.				
		Bowers.	Stream.	Kedge.	Weight.	Test.	Collective Weight.	Stream.	Test.	Kedge.	Test.	Length.	Minimum Size.	Proved to Statutory Test.	Breaking Test.	Minimum Weight.
					Kilogs.	Kilogs.	Kilogs.	Kilogs.	Kilogs.	Kilogs.	Kilogs.	Metres.	mm.	Kilogs.	Kilogs.	Kilogs.
195	*a*	2	1	1	180	6030	355	40	—	25	—	220	17,5	8670	13010	1480
230	*b*	2	1	1	215	6690	430	65	3730	25	—	220	19	10240	15290	1740
280	*c*	2	1	1	255	7490	510	75	3950	40	—	250	20,5	11900	17840	2320
315	*d*	2	1	1	290	8090	585	75	3950	40	—	300	22	13700	20550	3170
360	*e*	2	1	1	330	8890	660	100	4550	50	—	300	23,5	15640	23460	3660
400	*f*	2	1	1	370	9630	735	115	4830	50	—	300	25	17720	26570	4110
445	*g*	3	1	1	420	10540	1195	125	5050	65	3730	300	27	20640	30920	4810
490	*h*	3	1	1	510	12230	1450	190	6240	90	4280	355	28,5	23010	34510	6350
550	*i*	3	1	1	610	14070	1740	205	6480	100	4550	355	30	25520	38210	7040
605	*j*	3	1	1	685	15380	1955	240	7200	125	5050	385	31,5	28130	42110	8420
660	*k*	3	1	1	775	16980	2210	265	7650	125	5050	385	33	30860	46300	9230
715	*l*	3	1	1	865	18560	2465	280	7940	140	5340	440	35	34700	52050	11860
780	*m*	3	1	1	965	20160	2745	330	8890	165	5790	440	36,5	37640	56410	12890
855	*n*	3	1	1	1065	21920	3050	370	9630	180	6030	440	38	40940	59350	13970
940	*o*	3	1	1	1195	23900	3405	405	10240	205	6480	495	39,5	44260	61910	16940
1030	*p*	3	1	1	1295	25540	3695	430	10740	215	6690	495	41	47630	66700	18170
1145	*q*	3	1	1	1410	27330	4015	445	11030	230	6980	495	42,5	51340	71890	19420
1265	*r*	3	1	1	1525	29060	4345	485	11780	240	7200	495	44	54880	76800	20870
1400	*s*	3	1	1	1625	30550	4635	535	12630	265	7650	495	46	59970	83940	22670
1560	*t*	3	1	1	1730	32130	4930	545	12830	280	7940	495	47,5	64080	89680	24230
1730	*u*	3	1	1	1855	33950	5285	570	13280	280	7940	495	49	68000	95200	25620
1905	*v*	3	1	1	1930	35040	5500	585	13570	290	8090	495	50,5	72300	101230	27100
2110	*w*	3	1	1	2030	36300	5790	610	14080	305	8380	495	52	76580	107200	28810
2340	*x*	3	1	1	2135	37790	6085	685	15380	345	9170	550	55,5	87500	122400	36440
2590	*y*	3	1	1	2285	39870	6515	775	16980	380	9790	550	58,5	97200	136100	40440
2860	*z*	3	1	1	2440	41770	6960	865	18560	430	10740	550	60	102000	142800	42560

* Where the equipment number lies between any two consecutive numbers given in the Table the equipment is to be governed by the greater.

ANCHORS and CHAINS for SAILING VESSELS.

TABLE 54
(CONCLUDED.)

*EQUIPMENT NUMBER.	Letters for Equipment as inserted in Register Book, Column 8	STREAM, CHAIN OR STEEL WIRE.						TOWLINE HEMP OR STEEL WIRE.				HAWSERS AND WARPS. HEMP OR STEEL WIRE.						
			Chain.			Flexible Steel Wire Rope.			Hemp.	Flexible Steel Wire Rope.			Hawsers.			Warps.		
		Length.	Size.	Minimum Weight.		Size. (*b*)	Breaking Test.	Length.	Size.	Size. (*b*)	Breaking Test.	Length of Each.	Number.	Hemp.	Flexible Steel Wire Rope.	Number.	Hemp.	Flexible Steel Wire Rope.
				Stud Link.	Short Link.									Size.	Size. (*b*)		Size.	Size. (*b*)
		Metres.	mm.	Kilogs.	Kilogs.	mm.	Kilogs.	Metres.	mm.	mm.	Kilogs.	Metres.		mm.	mm.		mm.	mm.
195	*a*	85	11	265	305	—	—	135	127	44	6500	165	1	76	—	—	—	—
230	*b*	85	13	350	390	—	—	135	140	51	8430	165	1	76	—	—	—	—
280	*c*	85	13	350	390	—	—	135	140	51	8430	165	1	76	—	—	—	—
315	*d*	85	13	350	390	—	—	135	152	57	10970	165	1	89	—	—	—	—
360	*e*	85	14,5	405	440	51	8430	135	165	57	10970	165	1	102	—	—	—	—
400	*f*	85	14,5	405	440	51	8430	135	165	57	10970	165	1	102	—	—	—	—
445	*g*	85	16	490	545	57	10970	135	178	64	13410	165	1	102	—	—	—	—
490	*h*	85	16	490	545	57	10970	135	190	64	13410	165	1	127	44	—	—	—
550	*i*	110	17,5	710	810	70	15450	135	203	70	15450	165	1	140	51	—	—	—
605	*j*	110	17,5	710	810	70	15450	135	203	70	15450	165	1	140	51	—	—	—
660	*k*	110	19	870	960	70	15450	135	216	70	15450	165	1	152	57	—	—	—
715	*l*	110	19	870	960	70	15450	135	229	76	18900	165	1	165	57	—	—	—
780	*m*	110	20,5	1020	1110	76	18900	135	—	83	22050	165	1	178	64	—	—	—
855	*n*	110	20,5	1020	1110	76	18900	165	—	83	22050	165	1	178	64	1	102	—
940	*o*	110	22	1160	1270	83	22050	165	—	83	22050	165	1	203	70	1	127	44
1030	*p*	135	22	1420	1560	83	22050	165	—	83	22050	165	1	203	70	1	127	44
1145	*q*	135	23,5	1650	1780	89	26110	165	—	83	22050	165	1	229	76	1	140	51
1265	*r*	135	23,5	1650	1780	89	26110	165	—	83	22050	165	1	229	76	1	140	51
1405	*s*	135	25	1850	2000	95	29770	165	—	89	26110	165	1	—	83	1	152	57
1560	*t*	135	25	1850	2000	95	29770	165	—	89	26110	165	1	—	83	1	152	57
1730	*u*	135	27	2160	2320	102	33730	165	—	89	26110	165	1	—	83	1	165	57
1905	*v*	135	27	2160	2320	102	33730	165	—	102	33730	165	1	—	89	1	178	64
2110	*w*	185	28,5	3270	3450	108	36800	165	—	102	33730	165	1	—	89	1	178	64
2340	*x*	220	28,5	3970	4260	108	36800	165	—	114	44000	165	1	—	102	1	203	70
2590	*y*	220	30	4360	4650	114	44000	165	—	114	44000	165	1	—	102	1	203	70
2860	*z*	220	31,5	4800	5120	121	47750	220	—	121	47750	165	1	—	114	1	229	76

* Where the equipment number lies between any two consecutive numbers given in the Table the equipment is to be governed by the greater.

(*b*) 6 × 12 Flexible Steel Wire Ropes.

EQUIPMENT for TUGS. TABLE 55

*SECOND LONGITUDINAL NUMERAL L×(B+D)	ANCHORS. Number.	ANCHORS. Weight Ex Stock. 1st Bower.	ANCHORS. Weight Ex Stock. 2nd Bower.	ANCHORS. Weight Stockless. 1st Bower.	ANCHORS. Weight Stockless. 2nd Bower.	CHAIN. Length.	CHAIN. Diameter.	CHAIN. Minimum Weight. Stud Link.	CHAIN. Minimum Weight. Short Link.	HAWSERS. Length.	HAWSERS. Size.	WARPS Length.	WARPS Size.
		Kilogs.	Kilogs.	Kilogs.	Kilogs.	Metres.	mm.	Kilogs.	Kilogs.	Metres.	mm.	Metres.	mm.
135	2	115	115	155	155	110	16	650	705	110	114	110	64
160	2	125	125	165	165	110	17,5	740	810	110	114	110	64
185	2	140	140	180	180	110	17,5	740	810	110	114	110	64
210	2	155	155	190	190	110	19	870	960	110	127	110	64
245	2	180	180	230	230	110	20,5	1020	1110	110	140	110	76
275	2	205	205	255	255	110	22	1160	1270	110	140	110	76
300	2	215	205	265	255	110	22	1160	1270	110	140	110	89
325	2	230	205	280	255	135	23,5	1650	1780	110	140	110	89
350	2	240	215	305	265	165	23,5	2000	2170	110	140	110	102
375	2	255	230	320	280	165	25	2260	2450	110	140	110	102
400	2	265	240	330	305	165	25	2260	2450	110	152	110	114
420	2	280	255	355	320	190	27	3040	3260	110	152	110	114
445	2	290	265	370	330	190	27	3040	3260	110	152	110	127
465	2	305	280	380	355	220	28,5	3950	4110	110	152	110	127
490	2	320	290	405	370	220	28,5	3950	4110	110	152	110	127
515	2	330	305	420	380	220	28,5	3950	4110	110	152	110	127
560	2	345	320	430	405	220	30	4360	4650	110	178	110	127
575	2	355	330	445	420	220	30	4360	4650	110	178	110	140
610	2	370	345	460	430	250	30	4950	5280	110	178	110	140
640	2	380	355	470	445	250	30	4950	5280	110	178	110	140
670	2	395	370	480	460	275	30	5450	5810	110	178	110	140
700	2	405	380	510	480	275	31,5	6000	6400	110	178	110	140

* Where the equipment number lies between any two consecutive numbers given in the Table the equipment is to be governed by the greater.

LLOYD'S REGISTER OF SHIPPING, LONDON.—16*th June*, 1927.

RENEWAL of CHAIN CABLES when WORN. TABLE 56

When any length of a Chain Cable is so worn that the mean diameter at its most worn part is reduced to the size given in the following Table, it is to be renewed.

ORIGINAL DIAMETER OF CHAIN CABLE.	MEAN DIAMETER REQUIRING RENEWAL OF CHAIN CABLE.	ORIGINAL DIAMETER OF CHAIN CABLE.	MEAN DIAMETER REQUIRING RENEWAL OF CHAIN CABLE.	ORIGINAL DIAMETER OF CHAIN CABLE.	MEAN DIAMETER REQUIRING RENEWAL OF CHAIN CABLE.	ORIGINAL DIAMETER OF CHAIN CABLE.	MEAN DIAMETER REQUIRING RENEWAL OF CHAIN CABLE.
mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
17,5	16	31,5	28,5	46	41	60	54
19	16,5	33	30	47,5	42,5	62	55,5
20,5	18,5	35	31	49	43,5	63,5	57
22	19,5	36,5	33	50,5	45,5	65	58
23,5	21,5	38	34	52	46,5	66,5	60
25	22,5	39,5	36	54	48,5	68	61
27	23,5	41	37	55,5	50	69,5	63
28,5	25	42,5	38	57	50,5	71	64
30	27	44	39,5	58,5	52	73	65

LLOYD'S REGISTER OF SHIPPING, LONDON.—13*th July*, 1922.

PROVING ESTABLISHMENTS.

The following Proving Establishments are recognised by the Committee of Lloyd's Register for the Testing of Anchors and Chains while licensed by the Board of Trade for that purpose :—

Netherton (near Dudley)—Lloyd's Proving House	Superintendent,	Mr. J. A. Relf.
Tipton—Lloyd's Proving House (*temporarily closed*)		
Low Walker-on-Tyne—Lloyd's Proving House	ditto	Mr. A. Green.
Chester (Saltney)—Lloyd's Proving House	ditto	Mr. J. R. Parsons.
Glasgow—Lloyd's Proving House	ditto	Mr. L. Haffner.
Cardiff—Lloyd's Proving House	ditto	Mr. L. L. Wright.
Sunderland—Lloyd's Proving House	ditto	Mr. J. H. Butler.
Cradley Heath—Lloyd's Proving House	ditto	Mr. S. C. Paul.

The following Machines have been recognised by the Committee for the testing of Anchors and Chain Cables supplied to vessels of other than British Registry (*see* Section 39 of the Rules for Steel Vessels) :—

Australia	Faulkiner Machinery Co., Proprietary, Lim., South Brisbane, Queensland.
Austria	F. F. von Helldorff & Otto Rothhart, Brückl-Kärnten.
Belgium	The Engineering Company, Rue des Indes, Antwerp.
,	Chaineries Mécaniques, Société Anonyme Fontaine l'Evêque (for the testing of small Chains only).
,,	Demaret (Edmond) & Cie.—Société en commandite simple, Heppignies, near Fleurus.
,,	Mercantile Marine Engineering and Graving Dock Co., Antwerp.
,,	Société Anonyme des Forges de Courcelles—Centre, Courcelles (for testing Chains up to 52 tons).
,,	Société Anonyme des Usines Wattelar-Francq., Jumet.
Canada	Thos. Davidson Manufacturing Co., Lim., Turcot, Montreal.
,,	Dominion Chain Co., Lim., Niagara Falls, Ontario.
,,	McKinnon-Columbus Chain, Lim., St. Catherine's, Ontario.
Czecho-Slovakia	Banska a Hutni Spolecnost (Berg-und Hüttenwerks-Gesellschaft), Praha II., *Works at* Maly Moravka (for testing chains up to 50 tons).
,,	Voigtmann & Söhne, Janowitz, near Römerstadt, Mähren.
Danzig	International Shipbuilding and Engineering Co., Lim.
Denmark	Government Establishment at Copenhagen.
France	Ateliers & Chantiers Maritimes du Sud Ouest, Bordeaux.
,,	Bievelot & Co., Havre.
,,	Chaineries de Saint-Nazaire, Saint Nazaire.
,,	Chantiers de la Loire, Nantes.
,,	Davaine (H.), Fils et Cie, St. Amand-les-Eaux (Nord).
,,	E. Turbot, Anzin (Nord).
,,	Etablissement Sirot-Mestreít, Saint Amand-les-Eaux (Nord).
France (*Cont.*)	Forges de la Chaussade, Guérigny (Nièvre).
,,	Marit, Isidore, Raismes (Nord).
,,	Paoli (J.) & Co., Marseilles.
,,	Société Anonyme des Chaineries de St. Amand-les-Eaux, Etablissements Dorémieux fils & Cie. E. Quinet, St. Amand-les-Eaux (Nord).
,,	Société Nouvelle des Forges & Chaineries du Nord, St. Amand-les-Eaux (Nord).
,,	Veille & Co., Havre.
,,	Ziegler Frères, Dunkirk.
Germany	A. Borsig, Berg und Hüttenverwaltung Borsigwerk, Borsigwerk, Upper Silesia.
,,	Deutsche Maschinenfabrik A. G., Duisburg.
,,	Gutehoffnungshütte A. G., Sterkrade.
,,	Hansa Kettenfabrik, Haunschild & Co., Dortmund.
,,	Heinrich Usinger, Hamburg.
,,	Joto Werke, Warmen, near Frondenberg.
,,	Marinewerft, Wilhelmshaven.
,,	Otto Gruson & Co., Magdeburg-Buckau.
,,	Stülcken (H. C.) Sohn, Schiffswerft und Maschinenfabrik, Hamburg.
,,	Theile (J. D.), Schwerte, Westphalia.
,,	Vereinigte Stahlwerke A. G. Dortmunder Union, Dortmund (for the testing of Anchors only). Branch Kettenwerke Schlieper, Grüne, Westphalia ; also Sichtigvor, Westphalia.
Holland	Amsterdamsche Droogdok Maatschappij, Amsterdam.
,,	Koninklijke Nederlandsche Grofsmederij, Leiden.
,,	N.V. Anker- & Ketting-Industrie "Schiedam" (Managing Director—P. Th. Verhoeff), Schiedam.
Italy	Catenificio Ing. Carlo Bassoli & Co., Leghorn.
,,	Direzione Costruzioni Navali dell'Arsenale, Pola (approved for loads 50 tons upwards).
,,	Laminatojo Arlenico, Lecco.

ITALY (*Cont.*)	Regia Marina — Direzione Costruzioni Navali — Laboratorio Sperimentale, Regio Arsenale, Spezia.
	Società Anonima Acciaierie Weissenfels—Fusine in Valromana, Friuli (for the testing of small Chains only).
„	Società Italiana Acciaierie Cornigliano, Genoa-Cornigliano.
JAPAN	Kobe Steel Works, Kobe (for the testing of Anchors only).
„	Kokko Chain and Steel Works, Lim., Osaka.
„	Mitsu Bishi Dockyard & Engine Works, Nagasaki.
„	Murakami Iron Works, Lim., Osaka.
„	Nippon Mechanical Chain Works, Lim., Osaka.
„	Osaka Chain and Machinery Works, Lim., Osaka.
„	Osaka Chain Works, Yokohama.
„	Oshima Steel Works, Oshima, Tokio (for the testing of Anchors only).
„	Tokyo Seisa Tekko Kabushiki Kaisha (Tokyo Chain and Iron Works), Kameido, Tokyo.
NORWAY	A/S Kjaettingfabriken, Oslo (for testing Chains up to 30 tons).
„	Royal Naval Dockyard, Horten.
SPAIN	Hijos di Vicinay, S. en C., Ochandiano, Vizcaya.
„	Viuda e Hijos de J. Arregui, Durango.
SWEDEN	Gunnebo Bruks Nya Aktiebolag, Västervik (for testing Chains up to 20 tons).
	Ljusne Chain Works (Ljusne Kätting-fabrik), Ljusne.
„	Ramnäs Bruks Aktiebolag, Ramnäs.
„	Statens Profningsanstalt (Government Establishment), Stockholm.
UNITED STATES	American Chain Co., Columbus, Ohio; Braddock, near Pittsburgh, Pa.; and York, Pa. (for testing Chains up to 22 tons).
UNITED STATES (*Cont.*)	Baldt Anchor, Chain and Forge Corporation Chester, Pa.
„ „	Bellingham Chain & Forge Co., South Bellingham, Wash.
„ „	Bradlee & Co., Inc., Philadelphia, Pa.
„ „	Buckeye Steel Castings Co., Columbus, Ohio (for breaking tests on Chain Cables only).
„ „	Carroll Chain Co., Columbus, Ohio.
„ „	Cleveland Chain & Manufacturing Co., Cleveland, Ohio.
„ „	Cleveland Steel Casting Co., Cleveland, Ohio (for the testing of Anchors only).
„ „	Columbia Steel Co., Lim., Pittsburgh, Cal. (for the testing of Anchors only).
„ „	Columbus McKinnon Chain Co., Columbus, Ohio, and Lebanon, Pa.
„ „	General Steel Castings Corporation, Eddystone, Pa. (for the testing of Anchors only).
„ „	Herreshoff Manufacturing Co., Bristol, R.I. (for the testing of Anchors only).
„ „	Johnson-Farmer Chain Co., Lebanon, Pa.
„ „	Jones & Laughlin Steel Co., Pittsburgh, Pa.
„ „	Knoxville Iron Co., Knoxville, Tenn.
„ „	National Malleable Castings Co., Cleveland, Ohio, and Sharon, Pa.
„ „	Penn Steel Castings Corporation, Chester, Pa. (for the testing of Anchors only).
„ „	Portland Chain Manufacturing Co., Portland, Or.
„ „	Round California Chain Corporation, Lim., South San Francisco, California.
„ „	Seattle Chain Co., 6921, East Marginal Way, Seattle, Wash.
„ „	Seneca Chain Co., Kent, Ohio.
„ „	Taylor (S. G.) Chain Company, Hammond, Indiana.
„ „	United States Chain & Forging Co., Pittsburgh, Pa.
„ „	Weimer Chain & Iron Co., Lebanon, Pa.
„ „	Whitehill Chain Works, Fieldsboro' N.J.
„ „	Woodhouse Chain Works, Trenton, N.J.

N.B.—Vessels supplied with Anchors and Chain Cables tested at any of the Establishments in the foregoing lists will have the notation of "Lloyd's A.&.C.P." in the Register Book, provided that in the case of machines outside Great Britain and Ireland the tests are carried out under the supervision of a Surveyor to the Society.

By order of the Committee,

MALCOLM K. SCOTT,

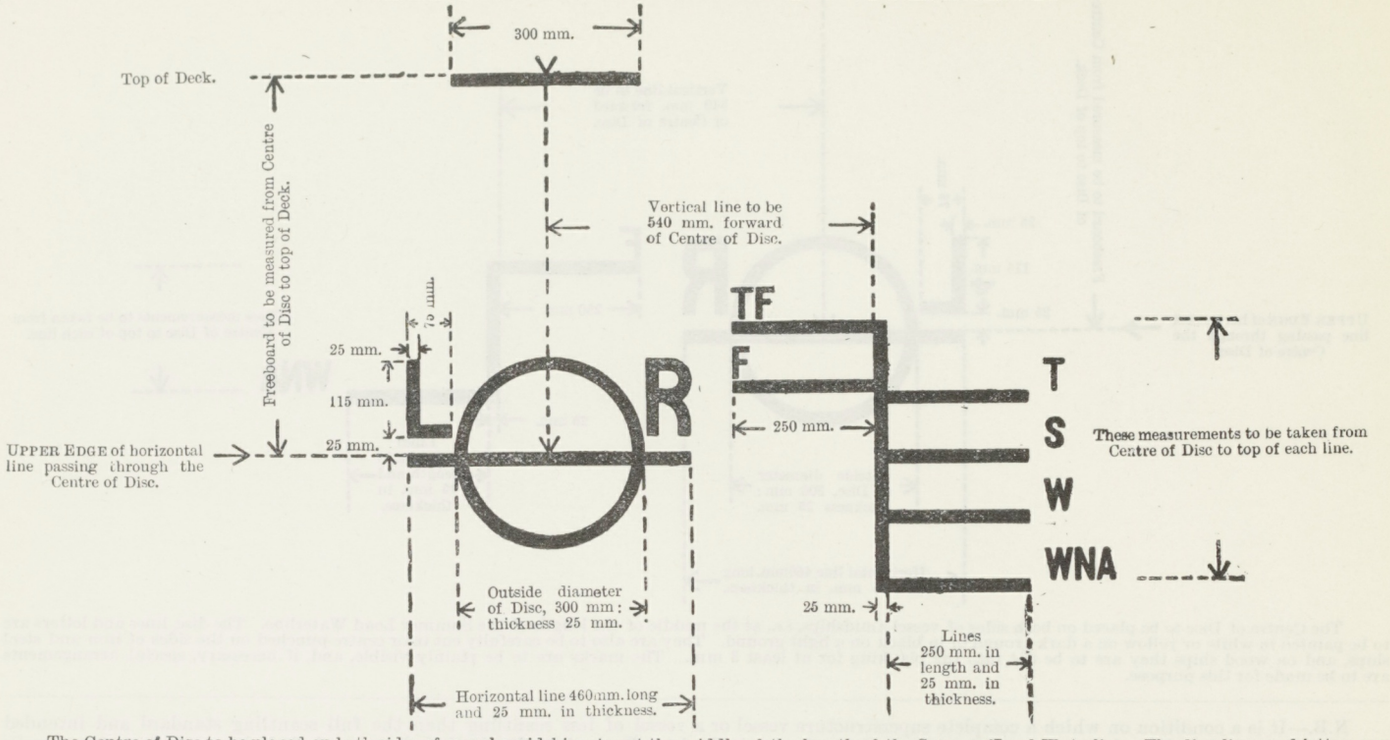
Secretary.

LONDON.—*July*, 1937.

ASSIGNMENT OF FREEBOARD.

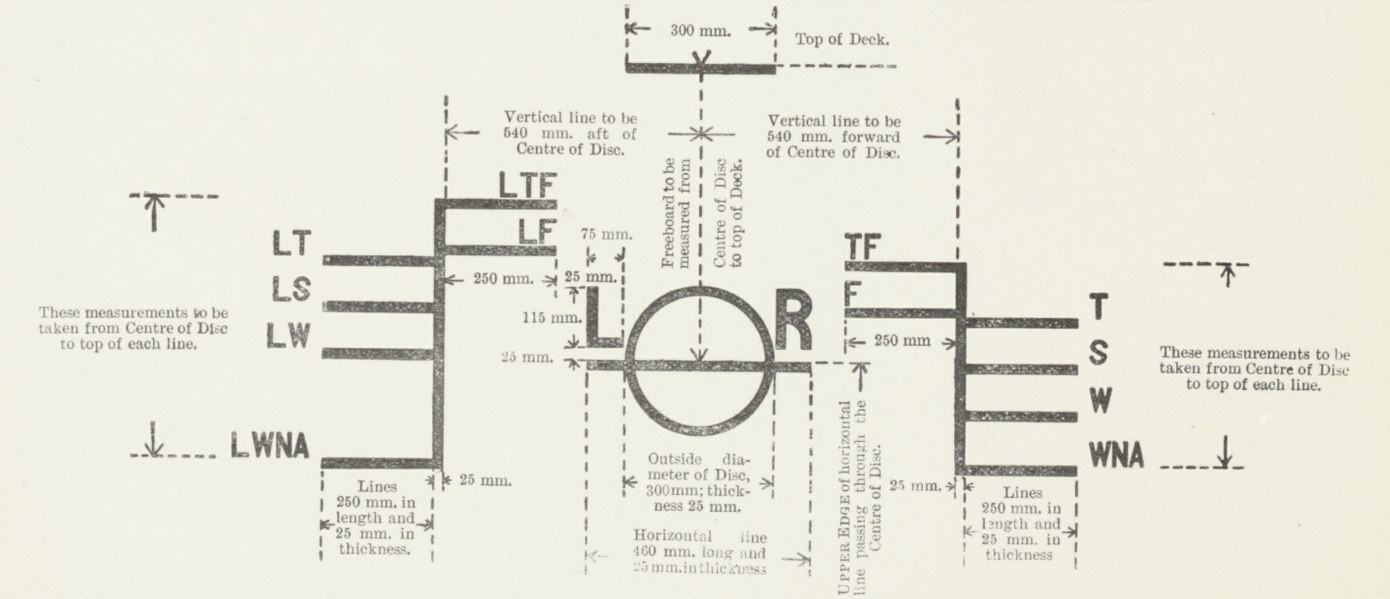
The Committee of Lloyd's Register are empowered to assign freeboards to British Vessels and to vessels registered in other countries. Forms of application for the assignment of freeboard can be obtained from the London, or other, offices of the Society.

FREEBOARD MARKING FOR STEAMERS.



The Centre of Disc to be placed on both sides of vessel amidships, *i.e.*, at the middle of the length of the Summer Load Waterline. The disc, lines and letters are to be painted in white or yellow on a dark ground or in black on a light ground. They are also to be carefully cut in or centre-punched on the sides of iron and steel ships, and on wood ships they are to be cut into the planking for at least 3 mm. The marks are to be plainly visible, and, if necessary, special arrangements are to be made for this purpose. Ships over 100 m. 50 in length are not required to be marked with the W.N.A. line.

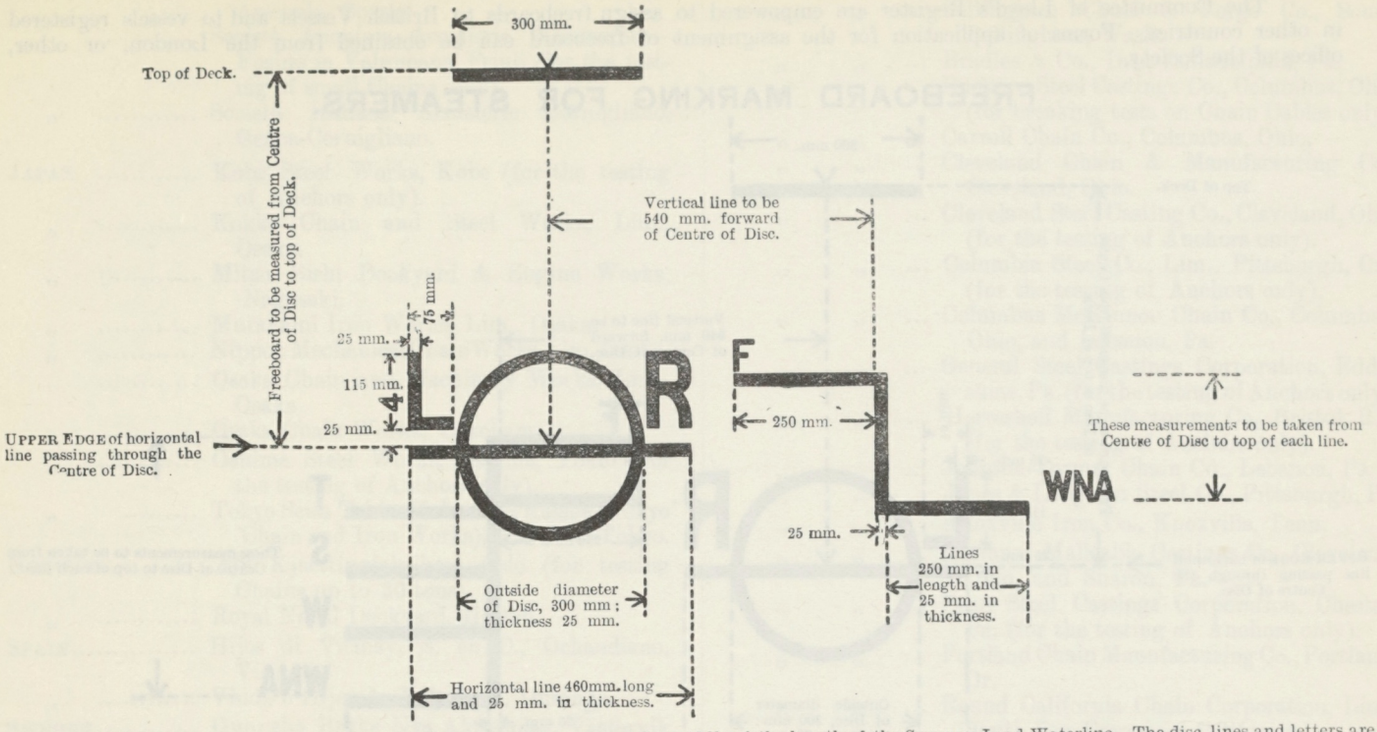
FREEBOARD MARKING FOR STEAMERS CARRYING TIMBER DECK CARGOES.



The Centre of Disc to be placed on both sides of vessel amidships, *i.e.*, at the middle of the length of the Summer Load Waterline. The disc, lines and letters are to be painted in white or yellow on a dark ground or in black on a light ground. They are also to be carefully cut in or centre-punched on the sides of iron and steel ships, and on wood ships they are to be cut into the planking for at least 3 mm. The marks are to be plainly visible, and, if necessary, special arrangements are to be made for the purpose. Ships over 100 m. 50 in length are not required to be marked with the W.N.A. line.

N.B.—It is a condition on which a complete superstructure vessel or a vessel of less scantling than the full scantling standard and intended for other than river or inland water service is classed in the Society's Register Book that the freeboard assigned shall be marked on the vessel's sides as above prescribed. If the vessel proceed to sea with a less freeboard than that approved by the Committee, or if the freeboard mark be placed higher than the position assigned by the Committee, the vessel will be liable to have her class expunged from the Register Book.

FREEBOARD MARKING FOR SAILING SHIPS.



The Centre of Disc to be placed on both sides of vessel amidships, *i.e.*, at the middle of the length of the Summer Load Waterline. The disc, lines and letters are to be painted in white or yellow on a dark ground or in black on a light ground. They are also to be carefully cut in or centre-punched on the sides of iron and steel ships, and on wood ships they are to be cut into the planking for at least 3 mm. The marks are to be plainly visible, and, if necessary, special arrangements are to be made for this purpose.

N.B.—It is a condition on which a complete superstructure vessel or a vessel of less scantling than the full scantling standard and intended for other than river or inland water service is classed in the Society's Register Book that the freeboard assigned shall be marked on the vessel's sides as above prescribed. If the vessel proceed to sea with a less freeboard than that approved by the Committee, or if the freeboard mark be placed higher than the position assigned by the Committee, the vessel will be liable to have her class expunged from the Register Book.